



CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

December 14, 2022
AGENDA ITEM #10

Discuss and consider approving an amended and restated agreement with Electronic Transaction Consultants, LLC (ETC) for electronic toll collection installation and maintenance services

Strategic Plan Relevance:	Innovation, Service and Stewardship
Department:	Operations
Contact:	Tracie Brown, Director of Operations
Associated Costs:	Not Applicable
Funding Source:	Not Applicable
Action Requested:	Consider and act on draft resolution

Project Description/Background: Electronic Toll Consultants, LLC (ETC) was previously awarded the 2021 RFP for Electronic Toll Collection System (ETCS) Integration and Maintenance Services. The scope of their work in support of the Mobility Authority includes incremental replacement and maintenance of ETCS equipment on all existing Mobility Authority toll projects, as well as implementation and maintenance of systems on new Mobility Authority toll projects.

Action Requested: Staff began working with the ETC project team immediately after the Agreement was executed, participating in multiple workshops to clarify the project scope and requirements. The project team also outlined the sequence in which the Mobility Authority's existing toll systems would be replaced, with the 71 Toll ETCS selected as the first such project. During these discussions, the teams identified several areas of the Agreement that need to be modified to ensure performance. These areas include bonding, revenue assurance, insurance, and Service Level Agreements (SLAs). The proposed amended and restated agreement addresses each of these topics.

Bonding & Revenue Assurance

To ensure adequate protection against loss of revenue incurred by the CTRMA due to acts or omissions of ETC for roads/lanes that are under the supervision and maintenance of ETC, staff recommends amending the Maintenance Performance Bond to include provisions for 60 days of revenue protection as well as requiring a \$10 million guaranty from ETC's parent company. Staff believes that this is adequate to protect the CTRMA from any potential revenue loss due to actions of ETC which might impact CTRMA projects.

Insurance

The following insurance coverage requirements will be provided for:

- Professional Liability: Increase current \$10M requirement to \$40M in coverage as offered by ETC
- Technology Errors & Omissions: Add \$10M coverage for programming errors or other errors that prevent toll collection
- Cyber/Network Security Liability: Increase current \$10M requirement to \$20M to cover the cost of forensic analysis to remove the virus, notification of affected individuals, etc.
- Employee Theft (aka Crime or Employee Dishonesty policy): Add requirement for \$10M coverage

Additional Modifications

Modifications are also proposed to other areas of the Agreement. These items are outlined below:

- Agreement - Article 7
 - Make conforming and clarifying changes related to revenue loss bond, supplemental nature of coverage, liability in excess of bond/security amounts
- Agreement - Article 13.d.iv
 - Add software escrow language in the event of default or termination
 - Add language that specifies a transfer of hosting environment / data / licenses / access to CTRMA or their designee in the event of default
- Appendix A - Scope of Work
 - Update Section 2.18 - Succession Plan
 - Update technical requirements as agreed to in agency / vendor workshops
- Appendix B - Work Authorization
- Appendix F - SLAs

- Appendices I-K – Forms of Payment & Performance Bonds
 - To align with changes to the revised bonding provisions

The not to exceed amount of \$79,720,455 approved by the Board in December 2021 remains the same.

Previous Actions & Brief History of the Program/Project: In December 2021, the Mobility Authority Board approved the contract with ETC for electronic toll collection integration and maintenance services. The initial term of the agreement is six (6) years with an option for two (2) successive two (2) year renewal terms, subject to the approval of the Mobility Authority’s Board of Directors. The total cost for the agreement is not to exceed \$79,720,455. This amount covers all toll collection system installation and maintenance services for new projects as well as existing projects as they are replaced.

In February 2022, the Executive Director approved WA #1 for design support services on the 183N Mobility Project. The total amount not to exceed for this work was \$287,971.93.

Financing: Various construction and operating accounts

Action requested/Staff Recommendation: Staff recommends the Board approve the amendment to the agreement with Electronic Transaction Consultants, LLC (ETC) for electronic toll collection integration and maintenance services.

Backup provided:
Draft amended and restated agreement
Presentation
Draft Resolution

**GENERAL MEETING OF THE BOARD OF DIRECTORS
OF THE
CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY**

RESOLUTION NO. 22-0XX

**APPROVING AN AMENDED AND RESTATED AGREEMENT FOR ROADSIDE TOLL
COLLECTION SYSTEM INSTALLATION AND MAINTENANCE SERVICES WITH
ELECTRONIC TRANSACTION CONSULTANTS, LLC**

WHEREAS, by Resolution No. 21-075 dated December 15, 2021, the Central Texas Regional Mobility Authority (Mobility Authority) Board of Directors (Board) approved an Agreement for Roadside Toll Collection System Installation and Maintenance Services with Electronic Transaction Consultants, LLC (ETC) in an amount not to exceed \$79,720,455; and

WHEREAS, the Executive Director and ETC have negotiated an Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services (the “Amended and Restated Agreement”) to reflect the revision of provisions related to loss of revenue, insurance requirements, and performance standards and with no change to the previously approved not to exceed amount, in the form or substantially the same form attached hereto as Exhibit A; and

WHEREAS, the Executive Director recommends that the Board approve proposed the Amended and Restated Agreement with ETC in the form or substantially the same form attached hereto as Exhibit A.

NOW THEREFORE, BE IT RESOLVED, that the Board hereby authorizes the Executive Director to finalize and execute Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services with Electronic Transaction Consultants, LLC in the form or substantially the same form attached hereto as Exhibit A.

Adopted by the Board of Directors of the Central Texas Regional Mobility Authority on the 14th day of December 2022.

Submitted and reviewed by:

Approved:

James M. Bass
Executive Director

Robert W. Jenkins, Jr.
Chairman, Board of Directors

Exhibit A

CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY

AMENDED AND RESTATED

AGREEMENT FOR

ROADSIDE TOLL COLLECTION SYSTEM

INSTALLATION AND MAINTENANCE SERVICES

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**CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY
AMENDED AND RESTATED AGREEMENT FOR
ROADSIDE TOLL COLLECTION SYSTEM INSTALLATION AND MAINTENANCE
SERVICES**

This Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services (the “Agreement”) is made and entered into by and between the Central Texas Regional Mobility Authority (the “CTRMA”), a regional mobility authority and a political subdivision of the State of Texas, and Electronic Transaction Consultants, LLC (the “Contractor”), to be effective as of the [__]th day of [____], 202[_] (the “Effective Date”). The purpose of the Agreement is to provide for the implementation of roadside toll collection equipment on one or more CTRMA Projects and potentially projects of other toll authorities, as well as to provide for maintenance services for the roadside toll collection equipment.

WITNESSETH:

The parties acknowledge the following:

WHEREAS, pursuant to that certain Request for Proposals dated March 18, 2020 (the “RFP”), the CTRMA sought to identify and obtain the services of a qualified firm to provide toll collection system installation and maintenance services for the CTRMA, and, potentially, other regional mobility authorities; and

WHEREAS, five (5) firms were shortlisted from a total of six (6) firms that submitted responses setting forth their respective qualifications and proposals for the work; and

WHEREAS, pursuant to Resolution No. 21-075, approved on December 15, 2021, the CTRMA Board of Directors (the “Board”) selected the Contractor as the best value proposer to provide the required services; and

WHEREAS, the Parties executed the Agreement for Roadside Toll Collection System Installation and Maintenance Services, effective December 15, 2021 (the “2021 ETCS Agreement”); and

WHEREAS, the Parties in this instrument desire to amend and restate the 2021 ETCS Agreement in its entirety to reflect the revision of provisions related to loss of revenue, insurance requirements, and performance standards; and

WHEREAS, pursuant to Resolution No. [____], approved on [____], 202[____], the Board authorized the execution of this Agreement; and

WHEREAS, this Agreement has been negotiated and finalized between the parties whereby services will be provided by the Contractor and compensation will be paid by the CTRMA pursuant to the terms hereof.

NOW, THEREFORE, in consideration of the benefits received and realized by the respective parties hereto, the parties do hereby agree as follows:

ARTICLE 1
THE SERVICES

The CTRMA hereby retains the Contractor, as an independent contractor, and the Contractor agrees to provide toll collection system installation and maintenance services to the CTRMA, and possibly other toll authorities upon the terms and conditions provided in this Agreement. The scope of services are described in Appendix “A”, and shall include, but not be limited to: (1) the design and implementation of an electronic toll collection system (“ETCS”) for newly constructed or expanded CTRMA projects and replacement of existing toll collection systems on CTRMA projects (the “Installation Services”); and (2) maintenance of the ETCS (the “Maintenance Services”) (the Installation Services and Maintenance Services, along with other services described in Appendix “A”, are collectively referred to herein as the “Services”). In performing the Services, the Contractor shall comply with the business rules set forth in Appendix “A” (the “Business Rules”) which set for the criteria and conditions for various operational requirements of the ETCS.

The Contractor acknowledges and agrees that the Services provided for herein will be provided to the CTRMA and may also be provided for the benefit of other toll authorities through agreements between the CTRMA and the other entities. All terms related to the performance of the Services hereunder to and for the CTRMA shall apply equally to Services provided to other toll authorities, and the CTRMA shall have the right, without objection from the Contractor, to seek performance hereunder and enforce the terms of this Agreement on its own behalf and on behalf of any other entities receiving the Services provided for herein.

The Contractor shall be expected to operate independently from the CTRMA and without extensive oversight and direction. The Contractor represents and warrants that it shall commit the personnel and resources required to respond promptly and fully to the responsibilities and tasks assigned by the CTRMA throughout the term of the Contractor’s performance of the Services described in this Agreement.

ARTICLE 2
PROSECUTION OF WORK AND COMPENSATION

The CTRMA Board of Directors has established a not to exceed amount of \$79,720,455.00 for this Agreement. In no event will the not to exceed amount be exceeded without prior approval by the CTRMA Board of Directors. No compensation shall be paid for work performed that is not authorized by the CTRMA Executive Director in a written Work Authorization, as described below. Authorization for Contractor to perform the Services, payment of compensation for Contractor’s work, and other aspects of the mutual obligations concerning Contractor’s work and payment therefore are as follows:

2.1 INSTALLATION SERVICES

a. Commencement of Work. The Contractor shall not proceed with any Installation Services until a Work Authorization has been issued pursuant to subsection 2.1.b. below. Each Work Authorization for an existing CTRMA Project shall include a transition plan

within the scope, generally describing a sequence and schedule for replacing and/or installing roadside toll collection equipment on the CTRMA Project.

b. Work Authorizations. Each activity, task, or project related to the Installation Services shall be performed pursuant to a separate Work Authorization, signed by the CTRMA and the Contractor. Work shall be performed in accordance with the scope, schedule, and budget set forth in said Work Authorization. The standard form of Work Authorization is attached hereto as Appendix “B” and made a part hereof. The standard form of Work Authorization may be modified during the term of this Agreement at the direction of the CTRMA or as agreed to by the Parties. No amendment of this Agreement is required if the standard form of Work Authorization is amended.

Upon written (including emailed) request from the CTRMA, the Contractor shall prepare a Work Authorization for a specific task or project, to be submitted for the CTRMA’s approval. A proposed Work Authorization must be submitted within thirty (30) days of receipt of the written (or emailed) request. No work shall begin on the activity until the Work Authorization is approved by the CTRMA’s Executive Director and is fully executed. The basis for payment on each Work Authorization will be stated in the Work Authorization as either (i) a lump sum, which may be paid in multiple milestone payments, or (ii) cost plus, using the Installation Service Unit Prices shown in Appendix “C” and estimated hours calculated based on the labor rates shown in Appendix “E”. In all cases a maximum “not-to-exceed” amount for the work will be identified in the Work Authorization, and in no event will the maximum be exceeded without prior approval by the CTRMA Executive Director.

The assignment and authorization of work, if any, shall be at the sole discretion of the CTRMA.

c. Early Completion Incentives. As an inducement to the Contractor to complete the Installation Services subject to a particular Work Authorization in advance of the original completion deadline, the CTRMA may specify in a Work Authorization an amount to be paid as an early completion incentive, and a methodology for determining when all or a portion of the incentive payment has been earned. If, at the option of the CTRMA, an early completion incentive is made available, the maximum amount thereof shall be reflected in the Work Authorization as part of the not to exceed amount stated therein. The CTRMA is not required to make an early completion incentive available on any project or in any Work Authorization.

d. Delays in Completing Installation Services. It is critical to the financial stability of the CTRMA and essential for the convenience of the traveling public that the performance of Installation Services is carried out in accordance with the schedules set forth in any Work Authorization. Damages for failure to meet a schedule deadline are difficult to estimate, and therefore shall result in liquidated damages being assessed by the CTRMA at a rate specified in the applicable Work Authorization, unless specific time extensions have been requested by the Contractor and approved by the CTRMA, at its sole discretion. The CTRMA reserves the right to deduct the amount of liquidated damages from any funds due the Contractor. If retained funds or other funds due the Contractor are not sufficient to cover the liquidated damages, the Contractor, or surety (as set forth in Article 7) shall promptly pay the amount due. Nothing herein shall preclude the delay in performance from being an event providing for notice and possible

termination under Article 4. Without waiving the foregoing, if at any time during the term of this Agreement the Contractor cannot provide the requested Installation Services within the time required by the CTRMA or for any other reason, the CTRMA may, without waiving any other rights it may have under this Agreement, procure the Installation Services from any other source it deems capable of providing those Installation Services.

e. Adjustment of Installation Services Prices. The initial prices to be used for establishing the Installation Services Unit Prices in any Work Authorization are set forth in Appendix “C” and Appendix “E” and shall be adjusted annually commencing on the second anniversary of this Agreement to account for increases or decreases in the costs of labor and materials from the costs as of the Effective Date. Any increase or decrease in the annual adjustment shall not result in rates increasing or decreasing by more than 5% from the prior years’ adjustment. Notwithstanding the foregoing, the Installation Services Unit Prices in any Work Authorization in effect at the time of an adjustment will not be subject to such adjustment. Price adjustments subject to this subsection 2.1.e. shall be based on the following indices:

i. labor amounts shall be adjusted in accordance with the Consumer Price Index (CPI) for Urban Wage Earners and Clerical Installation Workers for the Austin, Texas metropolitan area (“all items”) as published by the U.S. Department of Labor, Bureau of Labor Statistics.

ii. material amounts shall be adjusted in accordance with the Electrical Machinery and Equipment Index (WPU 117), as published by the U.S. Bureau of Labor Statistics.

2.2 MAINTENANCE SERVICES

a. Commencement of the Maintenance Services. The initiation of the Maintenance Services shall commence with the issuance of a Work Authorization describing the facilities and equipment to be maintained. A Work Authorization for Maintenance Services will not be issued until all requirements under the Work Authorization for Installation Services for the applicable CTRMA Project have been completed to the satisfaction of the CTRMA, and any maintenance service required prior to the issuance of a Work Authorization for Maintenance Services shall be deemed to be part of the requirements of the Installation Services.

b. Fees and Charges. The CTRMA shall pay a monthly fee (the “Monthly Fee”) for the Maintenance Services to be performed using the Maintenance Services Unit Prices set forth in the Appendix “D” and for the equipment and facilities identified therein and, if applicable, the labor rates shown in Appendix “E”. The Monthly Fee shall be adjusted following the Initial Term as provided in subsection 2.2.e.

c. Revisions to Scope of Maintenance Services. Any revision to the scope of the Maintenance Services assigned to the Contractor in accordance with this Agreement, including but not limited to the addition or removal of lanes or segments of CTRMA projects or an adjustment in the price for the Maintenance Services, shall be implemented pursuant to a Supplemental Work Authorization authorized by the CTRMA, which shall also include any changes to the Monthly Fee.

d. Delays in Completing Maintenance Services. It is critical to the financial stability of the CTRMA and essential for the convenience of the traveling public that the performance of Maintenance Services is carried out in accordance with the Service Level Agreements (“SLAs”) set forth in Appendix “F”. Damages for failure to meet a schedule deadline are difficult to estimate, and therefore shall result in liquidated damages being assessed by the CTRMA at a rate specified in the Appendix “F”, unless specific time extensions have been requested by the Contractor and approved by the CTRMA, at its sole discretion. The CTRMA reserves the right to deduct the amount of liquidated damages from any funds due the Contractor. If retained funds or other funds due the Contractor are not sufficient to cover the liquidated damages, the Contractor, or surety (as set forth in Article 7) shall promptly pay the amount due. Nothing herein shall preclude the delay in performance from being an event providing for notice and possible termination under Article 4. Without waiving the foregoing, if at any time during the term of this Agreement the Contractor cannot provide the requested Maintenance Services within the time required by the CTRMA or for any other reason, the CTRMA may, without waiving any other rights it may have under this Agreement, procure the Maintenance Services from any other source it deems capable of providing those Maintenance Services.

e. Adjustment of Maintenance Services Prices. The Monthly Fee shall not be increased or decreased during the Initial Term except for adjustment as a result of adding additional lanes or segments resulting in an increase in fees, or closing existing lanes or segments resulting in a decrease in fees. The initial prices to be used for establishing the Monthly Fee are set forth in Appendix “D” and Appendix “E” and shall be adjusted annually commencing on the second anniversary of this Agreement to account for increases or decreases in the costs of labor and materials from the costs as of the Effective Date. Any increase or decrease in the annual adjustment shall not result in rates increasing or decreasing by more than 5% from the prior years’ adjustment. Price adjustments subject to this subsection 2.2.e. shall be based on the following indices:

i. labor amounts shall be adjusted in accordance with the Consumer Price Index (CPI) for Urban Wage Earners and Clerical Installation Workers for the Austin, Texas metropolitan area (“all items”) as published by the U.S. Department of Labor, Bureau of Labor Statistics.

ii. material amounts shall be adjusted in accordance with the Electrical Machinery and Equipment Index (WPU 117), as published by the U.S. Bureau of Labor Statistics.

2.3 COMPENSATION, GENERALLY

a. EXPENSES. The compensation described above is anticipated by the CTRMA and the Contractor to be full and sufficient compensation and reimbursement for the performance of the Services. The Contractor shall not be entitled to reimbursement from the CTRMA for out of pocket expenses incurred by the Contractor related to the performance of its duties under this Agreement.

b. INVOICES AND RECORDS. The Contractor shall submit a monthly invoice certifying the time sheets reflecting the number of hours worked by Contractor personnel and the costs associated with providing the Services under this Agreement during the previous month, and

shall also present a reconciliation of monthly invoices and the Work Authorization (and related estimates) to which the work relates. Each invoice shall be in such detail as is required by the CTRMA, including a breakdown of Services provided pursuant to specified Work Authorizations and, if applicable, a report reflecting the progress on each SLA subject to the specified Work Authorization. The costs associated with work performed on any Work Authorization will be tracked and reported to the CTRMA separately from other work performed by the Contractor. The monthly invoice to the CTRMA will include a progress summary of the work performed the previous month on each ongoing Work Authorization.

Upon request of the CTRMA, the Contractor shall also submit certified time and expense records and copies of invoices that support the invoiced time and expense figures. In the event that the work performed under this Agreement is subject to federal or state reporting requirements, Contractor shall submit any supporting information required to comply with such reporting requirements not otherwise provided for under this Agreement.

c. **EFFECT OF PAYMENTS.** Payment terms are net thirty (30) days after receipt of an undisputed invoice. No payment by the CTRMA shall relieve the Contractor of its obligation to timely deliver the Services required under this Agreement. If after approving or paying for any Service, product or other deliverable, the CTRMA determines that said Service, product, or deliverable does not satisfy the requirements of this Agreement, the CTRMA may reject the same and, if the Contractor fails to correct, cure, or provide a plan acceptable to the CTRMA for cure within a reasonable period of time, but no later than thirty (30) days after receipt of written notice of the manner in which a Service, product, or deliverable does not satisfy the requirements of this Agreement, and at no additional cost to the CTRMA, the Contractor shall return any compensation received therefore. In addition to all other rights provided in this Agreement, the CTRMA shall have the right to set off any amounts owed by the Contractor pursuant to the terms of this Agreement upon providing the Contractor prior written notice thereof. Disputed amounts are to be resolved pursuant to the dispute resolution process as provided in Article 38 of this Agreement. If it is determined that the CTRMA has wrongfully withheld amounts from payment, the CTRMA shall promptly pay all withheld amounts.

Except to the extent amounts owed may be set off as provided above, the CTRMA shall make timely payments for all undisputed amounts. If any undisputed amounts remain outstanding for more than sixty (60) days, the Contractor retains the right to suspend performance under this Agreement (including but not limited to suspending CTRMA's license to Software) without any further obligation or liability. Contractor's right to suspend performance is subject to first providing a written notice to the CTRMA detailing the undisputed amounts which have been outstanding for more than sixty (60) days. If the CTRMA fails to cure such outstanding undisputed amounts no later than thirty (30) days after receipt of the written notice, Contractor may suspend performance under this Agreement.

d. **TAXES.** The Contractor acknowledges that the CTRMA is a tax-exempt entity under Sections 151.309, et seq., of the Texas Tax Code.

ARTICLE 3
TERM OF AGREEMENT

It is understood and agreed that the initial term of this Agreement shall be a period of six (6) years, commencing on December 15, 2021 and concluding on December 15, 2027, (the “Initial Term”) subject to the earlier termination of this Agreement pursuant to Articles 4 or 5 below or further extension upon agreement of both parties. There shall be two (2) successive two (2) year renewal terms following the expiration of the Initial Term, each of which shall be subject to approval of the CTRMA Board of Directors. In addition to the Initial Term and the renewal terms, the parties may agree to extend the term of this Agreement in order for the Contractor to provide Maintenance Services for a period covering the useful life of the roadside toll collection equipment on CTRMA Projects installed by the Contractor pursuant to this Agreement.

In addition to any termination rights set forth in this Agreement, either party may elect not to extend the term of one or both of the renewal terms by providing one hundred eighty (180) days written notice to the other prior to the end of the then current term. Upon delivery of such written notice, the parties will commence the succession plan, as set forth in Appendix “A”. If at any time during the term of this Agreement the Contractor cannot provide the requested Services within the time required by the CTRMA or for any other reason, the CTRMA may, without waiving any other rights it may have under this Agreement, procure the Services from any other source it deems capable of providing those Services.

ARTICLE 4
TERMINATION FOR DEFAULT

Time is of the essence with respect to the performance and completion of all the Services to be furnished by the Contractor pursuant to Work Authorizations issued and which specify an agreed-upon completion or delivery date. Without limiting the foregoing, the Contractor shall furnish all Services in such a manner and at such times as the CTRMA may require. Except as provided below, should the Contractor at any time (a) not carry out its obligations under this Agreement or (b) not be providing the Services to be rendered hereunder in an expeditious and efficient manner and in full compliance with this Agreement, or if the Contractor shall fail in any manner to discharge any other of its obligations under this Agreement, the CTRMA may, upon providing the Contractor with not less than thirty (30) days prior written notice and opportunity to cure (provided that in no event shall the cure period be more than thirty (30) days from receipt of the written notice unless a plan for a longer cure period is provided by Contractor and approved by the CTRMA in its sole discretion), terminate this Agreement. Notwithstanding the foregoing, the CTRMA may terminate this Agreement by providing not less than five (5) days prior written notice (an no opportunity to cure) in the event the Contractor fails to provide any bond, including the renewal of any bond, pursuant to the requirements under Article 7.

Any such termination under this Article 4 shall not constitute a waiver or release by the CTRMA of any claims for damages, claims for additional costs incurred by the CTRMA to complete and/or correct the work described in this Agreement, or any other claims or actions arising under this Agreement or available at law or equity which it may have against the Contractor for its failure to perform satisfactorily any obligation hereunder, nor shall such termination

pursuant to this Article 4 or Article 5 below abrogate or in any way affect the indemnification obligations of the Contractor set forth in Article 17 hereof.

Contractor has provided the CTRMA with three (3) years of financial statements as part of its Proposal (as defined in Article 20), and has represented that it has experienced positive cash flow during that three (3) year period. Contractor shall have a continuing obligation under this Agreement to notify the CTRMA of: (i) any material adverse change in its financial position or the occurrence of any event which may result in an adverse change (such as claims, litigation, etc.); (ii) the failure to maintain a positive cash flow for any fiscal year during the term of this Agreement; or (iii) any event of insolvency or the initiation of any bankruptcy proceeding or other action seeking protection from creditors or claimants during the term of this Agreement. The failure to provide required notification shall be an event of default for which the CTRMA may terminate this Agreement without the requirement for notice as set forth in the preceding paragraph.

If the CTRMA terminates this Agreement as provided either in this Article 4 or Article 5, no fees of any type, other than fees due and payable as of the termination date pursuant to Article 2 hereof for work performed and acceptable to the CTRMA, shall thereafter be paid to or collected by the Contractor, and the CTRMA shall have a right to offset or otherwise recover any damages incurred by reason of the Contractor's breach hereof, together with the right to offset amounts owed to the Contractor pursuant to Article 7 hereof. In determining the amount of any payments owed to the Contractor, the value of the work performed by the Contractor prior to termination shall be no greater than the value that would result by compensating the Contractor in accordance with Article 2 hereof for all Services performed and expenses reimbursable in accordance with this Agreement.

ARTICLE 5 **OPTIONAL TERMINATION**

In addition to the process for termination described above, this Agreement may also be terminated as follows:

a. **GENERALLY.** The CTRMA has the right to terminate this Agreement at its reasonable option, at any time with or without cause, by providing sixty (60) days written notice of such intention to terminate pursuant to this subsection 5.a. hereof and by stating in said notice the optional termination date. Upon such optional termination, the CTRMA shall enter into a settlement with the Contractor upon an equitable basis as determined by the CTRMA, which shall fix the value of the work performed by the Contractor prior to the optional termination date. In determining the value of the work performed, the CTRMA in all events shall compensate the Contractor for any reasonable costs or expenses actually incurred and which are attributable to the exercise of the CTRMA's optional termination, on an equitable basis as determined by the CTRMA as noted above, provided, however, that no consideration will be given to anticipated profit which the Contractor might possibly have made on the uncompleted portion of the Services.

b. **NO FURTHER RIGHTS, ETC.** Termination of this Agreement and payment of an amount in settlement as described in this Article 5 shall extinguish all rights, duties, obligations, and liabilities of the CTRMA and the Contractor under this Agreement (except those which are

designated as surviving termination, including without limitation the indemnification obligations of Contractor set forth in Article 17), and this Agreement shall be of no further force and effect, provided, however, such termination shall not act to release the Contractor from liability for any previous default, known or unknown, either under this Agreement or under any standard of conduct set by common law or statute.

c. **NO FURTHER COMPENSATION.** If the CTRMA shall terminate this Agreement as provided in this Article 5, no fees of any type, other than fees due and payable as of the optional termination date, shall thereafter be paid to the Contractor, provided that the CTRMA shall not waive any right to damages incurred by reason of the Contractor's breach thereof. The Contractor shall not receive any compensation for Services performed by the Contractor after the optional termination date, and any such Services performed shall be at the sole risk and expense of the Contractor.

ARTICLE 6 **TERMINATION, GENERALLY**

The CTRMA's rights and options to terminate this Agreement, as provided in any provision of this Agreement, shall be in addition to, and not in lieu of, any and all rights, actions, options, and privileges otherwise available under law or equity to the CTRMA by virtue of this Agreement or otherwise. Failure of the CTRMA to exercise any of its said rights, actions, options, and privileges to terminate this Agreement as provided in any provision of this Agreement or otherwise shall not be deemed a waiver of any of said rights, actions, options, or privileges or of any rights, actions, options, or privileges otherwise available under law or equity with respect to any continuing or subsequent breaches of this Agreement or of any other standard of conduct set by common law or statute. Upon notice of termination of this Agreement by either of the parties, and subject to Article 13 hereto, the Contractor shall update and implement the succession plan, as required in Appendix "A" to ensure a smooth, efficient, and uninterrupted transition to any successor contractor or subcontractor.

ARTICLE 7 **SERVICE LEVEL AGREEMENTS AND PERFORMANCE GUARANTY**

a. **SLA NONCOMPLIANCE.** Timely and accurate performance of the Services is critically important to the CTRMA. Contractor has represented that it will perform the Services in a timely and accurate manner, and Contractor acknowledges that the failure to do so will cause material harm to the CTRMA. Without waiving any other rights provided for in this Agreement, the Parties have identified certain SLAs intended to assure that critical aspects of the Services are provided in a timely and reliable manner, and that if they are not that there are consequences for Contractor's failure to perform. The SLAs and a table showing financial consequences for failure to adhere to those SLAs is set for in Appendix "F". In the event Contractor fails to adhere to the standards associated with one or more SLAs, the CTRMA shall notify Contractor of such event of noncompliance and shall be authorized to withhold, or offset, the penalty amount indicated in Appendix "F" from amounts owed to the Contractor for Services performed. Nothing in this Article 7 shall preclude the CTRMA from asserting any other remedies related to the failure to perform in accordance with the SLAs, including without limitation termination pursuant to Article 5.

b. **LOSS OF REVENUE.** Notwithstanding any other provision in this Agreement and whether or not the performance of the Services is in conformance with the requirements specified herein (including the appendices), in the event the CTRMA incurs a loss of revenue due to any action or inaction of the Contractor, the Contractor shall be obligated to make payment to the CTRMA of all lost revenue and other direct damages associated with the loss, including payments made to the CTRMA's third-party vendors. In the event that the CTRMA is unable to determine the amount of lost revenue because data is lost or otherwise unavailable, the Parties agree that lost revenue shall be based on historical figures (e.g., traffic, payments) maintained by the CTRMA. The CTRMA may offset lost revenue and associated damages by reducing the amount of the subsequent Monthly Fee for each impacted toll facility.

c. **NON-REVENUE DAMAGES.** In the event the CTRMA incurs damages due to any action or inaction of the Contractor for its failure to perform satisfactorily any obligation under this Agreement, and which are not subject to subsection 7.b., then the Contractor shall be obligated to make payment to the CTRMA for any costs incurred by the CTRMA to complete and/or correct the work for which the Contractor failed to perform. The CTRMA may offset costs incurred by the CTRMA by reducing the amount of the subsequent Monthly Fee for each impacted toll facility. The maximum amount of payments Contractor is required to pay under this subsection 7.c. shall not exceed \$10,000,000, with such amount being exclusive of any proceeds paid under ETC insurance policies or by the surety on any bonds required by this Agreement..

d. **PAYMENT AND PERFORMANCE BONDS.** The Contractor shall furnish the performance bonds and a payment bonds described in this subsection 7.d (collectively, the "Bonds") in the exact form set forth in the applicable appendix to this Agreement. The Bonds do not serve as the full extent of the Contractor's liabilities under this Agreement but are intended to secure the Contractor's obligations in providing the Services as well as to ensure adequate compensation for loss of revenue incurred by the CTRMA under subsection 7.b.

i. **Surety Financial Requirements.** The Bonds shall be issued by a surety with an A.M. Best and Company rating level of A-minus (A-) or better, Class VIII or better, or as otherwise approved in writing by the CTRMA, in its sole discretion. If any bond previously provided becomes ineffective, or if the surety that provided the bond no longer meets the requirements hereof, the Contractor shall provide a replacement bond in the same form issued by a surety meeting the foregoing requirements, or other assurance satisfactory to the CTRMA in its sole discretion.

ii. **Installation Performance and Payment Bonds.** Upon issuance of each Work Authorization under Article 2, subsection 2.1, the Contractor shall provide, and continuously maintain in place for the benefit of the CTRMA, a performance bond in the form of Appendix "I-1" (a "Installation Performance Bond") and a payment bond in the form of Appendix "I-2" (a "Installation Payment Bond") for the Installation Services covered by each applicable Work Authorization. The Installation Performance Bond and Installation Payment Bond shall each be in an amount of 100% of the relevant Work Authorization cost. If a price is increased in connection with a Work Authorization, the CTRMA may, in its sole discretion require a corresponding proportionate increase in the amount of the applicable Installation Performance Bond and Installation Payment Bond.

The Contractor's obligation to maintain and provide the Installation Performance Bond and Installation Payment Bond with respect to the Installation Services shall continue throughout the term of the applicable Work Authorization, but the CTRMA will accept the Installation Performance Bond and Installation Payment Bond with a stated term of one (1) year with a statement set forth in the applicable bond that it shall be renewable annually in accordance with the surety's customary renewal practices, provided further that it shall be an event of default if a bond is not renewed and there is no replacement bond provided prior to the expiration of the bond. If such an event of default occurs, the CTRMA may terminate this Agreement by providing five (5) days written notice to ETC. The CTRMA will release any individual Installation Performance Bond relating solely to a Work Authorization upon the later of (1) expiration of the applicable warranty period related to such Work Authorization, provided that no outstanding claims are then pending or threatened against the Contractor hereunder, or (2) satisfaction of the conditions required for final acceptance of the Installation Services of the applicable Work Authorization. The CTRMA will release any individual Installation Payment Bond relating solely to a Work Authorization (1) upon receipt of (i) evidence satisfactory to the CTRMA that all persons eligible to file a claim against the bond have been fully paid and (ii) unconditional releases of liens and stop notices from all subcontractors who filed preliminary notice of a claim against the bond, (2) upon expiration of the statutory period for subcontractors to file a claim against the bond if no claims have been filed, or (3) upon satisfaction of the conditions required for final acceptance of the Installation Services of the applicable Work Authorization.

iii. Maintenance Performance and Payment Bonds. As a condition to any final acceptance for each Work Authorization under Article 2, subsection 2.1, and prior to the issuance of the Work Authorization under Article 2, subsection 2.2., the Contractor shall furnish the CTRMA with (a) a Maintenance Performance Bond in the form of Appendix "J-1" (with such modifications as the CTRMA approves in writing, in its sole discretion) (the "Maintenance Performance Bond"), and (b) a Maintenance Payment Bond in the form of Appendix "J-2" (with such modifications as the CTRMA approves in writing, in its sole discretion) (the "Maintenance Payment Bond").

The Maintenance Performance Bond and Maintenance Payment Bond shall each be in an amount equal to (a) 100% of the aggregate two-year cost for the Maintenance Services for the Work Authorization under Article 2, subsection 2.2.a. and any Supplemental Work Authorizations under Article 2, subsection 2.2.c.; and (b) sixty (60) days average of revenue for the prior year for the Project(s) subject to the Work Authorization under Article 2, subsection 2.2.a. and any Supplemental Work Authorizations under Article 2, subsection 2.2.c. If the price of the Maintenance Services or the sixty (60) days average revenue for the prior year is increased in connection with a Supplemental Work Authorization under Article 2, subsection 2.2.c., the Contractor shall provide a corresponding proportionate increase in the amount of the Maintenance Performance Bond and Maintenance Payment Bond. , provided that it shall be an event of default if the bonds reflecting the increased amounts are not provided within ten (10) business days of the date of the Supplemental Work Authorization providing for the increased amount. With respect to clause (b) of the first sentence of this paragraph, the CTRMA shall provide the Contractor each previous year's revenue values in a report sufficiently detailed and reasonably acceptable to the Contractor ("Revenue Report"). Contractor shall provide a new Maintenance Performance Bond

and Maintenance Payment Bond to the CTRMA within ten (10) business days receipt of the Revenue Report.

The Contractor's obligation to maintain and provide the current Maintenance Performance Bond and Maintenance Payment Bond with respect to the Maintenance Services shall continue throughout the term of this Agreement, but the CTRMA will accept the Maintenance Performance Bond and Maintenance Payment Bond with a stated term of at least two (2) years with a statement set forth in the applicable bond that it shall be renewable annually in accordance with the surety's customary renewal practices. Provided that the Contractor has paid the CTRMA any applicable damages, compensation for revenue losses, and any other amounts that are payable to the CTRMA under this Agreement, the Maintenance Performance Bond shall be released upon expiration of the term of this Agreement and after the satisfaction of all conditions required for completion of the Maintenance Services. Upon expiration of the term of this Agreement, the CTRMA will release the Maintenance Payment Bond (i) upon receipt of (A) evidence satisfactory to the CTRMA that all persons eligible to file a claim against the bond have been fully paid and (B) unconditional releases of liens and stop notices from all subcontractors who filed preliminary notice of a claim against the bond, or (ii) upon expiration of the statutory period for subcontractors to file a claim against the bond if no claims have been filed.

e. **CONTRACTOR PARENT GUARANTY.** The Contractor shall provide a Parent Guaranty in the form as attached to this Agreement as Appendix K. The Parent Guaranty shall be in the amount of ten million dollars (\$10,000,000) and applicable only to acts and omissions caused by the Contractor on roadways controlled by the Contractor under the terms provided in the Parent Guaranty. This Parent Guaranty shall be for collection only and of secondary recovery, meaning CTRMA must exhaust all administrative remedies under this Contract against Contractor before pursuing recovery under the Parent Guaranty.

ARTICLE 8 **SUSPENSION OR MODIFICATION OF SERVICES; DELAYS AND DAMAGES**

In addition to the foregoing rights and options to terminate this Agreement, the CTRMA may elect to suspend any portion of the Services of the Contractor hereunder, but not terminate this Agreement, by providing the Contractor with prior written notice to that effect. Thereafter, the suspended Services may be reinstated and resumed in full force and effect upon receipt from the CTRMA of written notice requesting same.

Similarly, the CTRMA may expand, cancel (in whole or part), or otherwise modify any portion of the Services previously assigned to the Contractor in accordance with this Agreement. Such modification may include, but is not limited to, technological advances resulting in the development of equipment, software or any other aspect of the Services that would benefit the CTRMA and is not contemplated under this Agreement. In the event the Services are modified, the Parties shall agree to and execute a Work Authorization and Contractor's compensation shall be adjusted (up or down) based on the rates set forth in Appendices "D" or "E" as applicable. Without limiting the foregoing, the Contractor agrees that no claims for damages or other compensation shall be made by the Contractor for any delays, hindrances or modifications occurring during the progress of any portion of the Services specified in this Agreement as a result of any suspension or modifications occurring during the progress of any portion of the Services

specified in this Agreement. Such delays or hindrances, if any, shall be provided for by an extension of time for such reasonable periods as the CTRMA may decide. It is acknowledged, however, that permitting the Contractor to proceed to complete any Services or any part of them after the originally specified date for completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the CTRMA or any of its rights herein.

ARTICLE 9
PERSONNEL, EQUIPMENT AND MATERIAL, GENERALLY

Contractor shall provide personnel and equipment as follows:

a. **ADEQUATE PERSONNEL, ETC.** The Contractor shall furnish and maintain, at its own expense, adequate and sufficient personnel (drawn from its own employees or from approved subcontractors) and equipment, in the reasonable opinion of the CTRMA, to perform the Services with due and reasonable diligence customary of a firm providing similar services and enjoying a favorable national reputation, and in all events without delays attributable to the Contractor which have a reasonable likelihood of adversely affecting the progress of others involved with one or more of the Projects. All persons, whether employees of the Contractor or of an approved subcontractor, providing the Services shall be fully licensed to the extent required by their professional discipline associations' codes or otherwise by law.

b. **REMOVAL OF PERSONNEL.** All persons providing the Services, whether employees of the Contractor or of an approved subcontractor, shall have such knowledge and experience as will enable them, in the Contractor's reasonable belief, to perform the duties assigned to them. Any such person who, as determined by the CTRMA in its sole discretion, is incompetent or by his/her conduct becomes detrimental to the provision of the Services shall, upon request of the CTRMA, immediately be removed from the Services. The Contractor shall furnish the CTRMA with a fully qualified candidate for the removed person within thirty (30) days thereafter, provided, however, said candidate shall not begin work under this Agreement unless and until approved by the CTRMA.

c. **CONTRACTOR FURNISHES EQUIPMENT, ETC.** Except as otherwise specified or agreed to by the CTRMA, the Contractor shall furnish all equipment, transportation, supplies, and materials required for its performance of Services under this Agreement.

ARTICLE 10
KEY PERSONNEL

The Contractor acknowledges and agrees that the individual(s) identified on Appendix "G" attached hereto and incorporated herein are key and integral to the satisfactory performance of the Contractor under this Agreement. Throughout the term of this Agreement, the Contractor agrees that the identified individual(s) will remain in charge of the performance of the Services and they shall devote substantial and sufficient time and attention thereto. The death or disability of any such individual, his/her disassociation from the Contractor or the approved subcontractor, or his/her failure or inability to devote sufficient time and attention to the Services shall require the Contractor promptly to replace said individual with a person suitably qualified and otherwise

acceptable to the CTRMA. If such individual has not been replaced by an individual approved by the CTRMA within thirty (30) days of the event requiring replacement, Contractor acknowledges that the CTRMA will suffer significant and substantial additional losses due to the unavailability of an approved individual and that it is impracticable and extremely difficult to ascertain and determine the actual losses which would accrue to the CTRMA in such event. Therefore, for each day that an individual identified on Appendix "G" is not filled by an approved individual, the CTRMA may require that the Contractor pay a daily liquidated amount with such amount calculated pursuant to the formula shown in Appendix "G".

ARTICLE 11
BUSINESS OPPORTUNITY PROGRAM AND POLICY COMPLIANCE

Contractor acknowledges that the CTRMA has a Business Opportunity Program and Policy ("BOPP") with which it requires contractors to comply in connection with Disadvantaged Business Enterprises. To the extent the Contractor utilizes third parties to provide the Services hereunder, Contractor agrees to comply with the BOPP and observe the guidelines set forth therein. Contractor shall provide annual reporting to the CTRMA (beginning one (1) year from the Effective Date) regarding its utilization of disadvantaged business enterprises ("DBEs") and the manner in which such utilization complies with, or deviates from, Contractor's commitment to DBE utilization as reflected in its response to the RFP attached as Appendix "H".

ARTICLE 12
PLANNING AND PERFORMANCE REVIEWS; INSPECTIONS

As directed by the CTRMA, key personnel shall meet with the CTRMA's Executive Director and/or his designee(s) upon request to: (a) assess the Contractor's performance of the Services; and (b) plan staffing levels to be provided by the Contractor to the CTRMA for the upcoming calendar quarter. The Contractor shall permit inspections of its Services and work by the CTRMA or its designated representative, when requested by the CTRMA. Nothing contained in this Agreement shall prevent the CTRMA from scheduling such other planning and performance reviews with the Contractor or inspections as the CTRMA determines necessary.

ARTICLE 13
OWNERSHIP OF REPORTS

Ownership of reports and related materials prepared by Contractor (or any subcontractor) at the direction of the CTRMA shall be as follows:

a. **GENERALLY.** Excluding Contractor's ownership rights as provided in Article 13.d., all of the documents, reports, plans, computer records, software maintenance records, discs and tapes, proposals, sketches, diagrams, charts, calculations, correspondence, memoranda, opinions, testing reports, photographs, drawings, analyses and other data and materials, and any part thereof, created, compiled or to be compiled by or on behalf of the Contractor solely under this Agreement ("work product"), including all information prepared for or posted on the CTRMA's website and together with all materials and data furnished to it by the CTRMA, shall at all times be and remain the property of the CTRMA and, for a period of four (4) years from completion of the Services or such period as is required by Texas law, whichever is longer, if at

any time demand be made by the CTRMA for any of the above materials, records, and documents, whether after termination of this Agreement or otherwise, such shall be turned over to the CTRMA without delay. The CTRMA hereby grants the Contractor a revocable license to retain and utilize the foregoing materials, said license to terminate and expire upon the earlier to occur of (a) the completion of Services described in this Agreement or (b) the termination of this Agreement, at which time the Contractor shall deliver to the CTRMA all such materials and documents. If the Contractor or a subcontractor desires later to use any of the data generated or obtained by it in connection with the Projects or any other portion of the work product resulting from the Services, it shall secure the prior written approval of the CTRMA. Notwithstanding anything contained herein to the contrary, the Contractor shall have the right to retain a copy of the above materials, records, and documents for its archives.

b. **SEPARATE ASSIGNMENT.** If for any reason the agreement of the CTRMA and the Contractor set forth in subsection 13.a. above regarding the ownership of work product and other materials is determined to be unenforceable, either in whole or in part, the Contractor hereby assigns and agrees to assign to the CTRMA all right, title, and interest that Contractor may have or at any time acquire in said work product and other materials which are prepared for this Agreement, without royalty, fee or other consideration of any sort, and without regard to whether this Agreement has terminated or remains in force. The CTRMA hereby acknowledges, however, that all documents and other work product provided by the Contractor to the CTRMA and resulting from the Services performed under this Agreement are intended by the Contractor solely for the use for which they were originally prepared. Notwithstanding anything contained herein to the contrary, the Contractor shall have no liability for the use by the CTRMA of any work product generated by the Contractor under this Agreement on any project other than for the specific purpose and Project for which the work product was prepared. Any other reuse of such work product without the prior written consent of the Contractor shall be at the sole risk of the CTRMA.

c. **DEVELOPMENT OF CONTRACTOR WORK PRODUCT.** The CTRMA acknowledges that the Contractor's work product will be developed using data that is available at the time of the execution of a given Work Authorization, and will not constitute any guarantee or other assurance of future events. The Contractor will prepare work product using practices that are standard procedures in the industry.

d. **OWNERSHIP OF MATERIALS, SOFTWARE AND LICENSES.** The CTRMA acknowledges and agrees that, the Contractor and/or its subcontractors or licensors of are the exclusive owners all copyrights, trade secret rights and related intellectual property rights (such rights together referred to herein as "Intellectual Property Rights") in all software and accompanying documentation developed, produced or implemented in connection with this Agreement by the Contractor, its officers, employees, subcontractors or agents (the "Software"). Except as expressly stated herein, this Agreement does not grant the CTRMA any rights in or to such Intellectual Property Rights. The Contractor reserves the right to grant licenses to use such Software to any other party or parties, provided that any such licenses do not affect the provision of any of the Services to the CTRMA pursuant to this Agreement.

i. The provisions of this subsection 13.d. shall be without prejudice to, and shall not interfere with the CTRMA's ownership of reports as provided for under subsections 13.a to 13.c. of this Agreement.

ii. The Contractor reserves all rights in Software and all Intellectual Property associated therewith that have not been expressly granted herein.

iii. For the duration of this Agreement, the Contractor hereby grants to the CTRMA a nonexclusive, non-sublicensable, non-transferable license to use the Software for such purposes and to the extent necessary to enable the CTRMA to receive the Contractor's Services under this Agreement. Notwithstanding anything to the contrary in this Agreement, the license referred to in this sub-clause (iii) shall not survive termination or expiration of this Agreement (except as required to facilitate succession to a new provider). Provided however that the license referred to in this sub-clause (iii) shall be extended for the limited purposes and term that may be necessary to give effect to any post termination or post expiration transition related obligations expressly undertaken by the Contractor under this Agreement, such that Contractor's Services shall remain continuous and uninterrupted for the duration of any post termination or post expiration transition period under this Agreement, with Contractor providing the CTRMA with all permissions and licenses necessary to enable the CTRMA to receive Contractor's Services throughout any such transition period, including permissions and licenses necessary for use of any third-party software implemented by Contractor under this Agreement.

iv. The CTRMA shall have no right to access or use the source code of the Software. Notwithstanding the foregoing, with respect to any contract between the Contractor and any cloud service hosting provider related to the provision of the Services, the Contractor shall grant the CTRMA, upon termination or expiration of this Agreement, all of the rights and privileges of such contract, including but not limited to the CTRMA's right to secure the cloud service hosting services directly from the cloud service hosting provider.

v. The CTRMA shall not attempt to make any part of the Software or any accompanying documentation supplied by the Contractor along with the Software, available to any third party, or otherwise allow access to the same to any third party except as required by law.

vi. The CTRMA shall not attempt to reverse compile, decompile, disassemble or reverse engineer the Software, nor shall it amalgamate, amend, incorporate, modify, reproduce, translate or otherwise alter the same into or with any other software or use the same in conjunction with any third party's software.

vii. For purposes of this Agreement, the term Software shall mean any software used by the Contractor or any subcontractor of the Contractor to provide the Services to the CTRMA, including any software owned or provided by the Contractor or by a sub-consultant of the Contractor.

ARTICLE 14 **SUBLETTING OF WORK**

The Contractor shall not sublet, assign, or transfer any part of the work or obligations included in this Agreement without the prior written approval of the CTRMA. Responsibility for sublet, assigned or transferred work shall remain in all instances with the Contractor.

ARTICLE 15
APPEARANCE AS WITNESS AND ATTENDANCE AT MEETINGS

Contractor shall cooperate with the CTRMA and requests for attendance at meetings and in various types of proceedings as follows:

a. **WITNESS.** If requested by the CTRMA, the Contractor shall prepare such exhibits as may be requested for all hearings and trials related to any of the Services provided under this Agreement.

b. **MEETINGS.** At the request of the CTRMA, the Contractor shall provide appropriate personnel for conferences at its offices, or attend meetings and conferences at (a) the various offices of the CTRMA, (b) the offices of the CTRMA's legal counsel, bond counsel, and/or financial advisors, or (c) any reasonably convenient location.

ARTICLE 16
**COMPLIANCE WITH LAWS AND AUTHORITY POLICIES; PROTECTION OF
DATA AND INFORMATION**

The Contractor shall comply with all federal, state, and local laws, statutes, ordinances, rules, regulations, codes and with the orders, judgements, and decrees of any courts or administrative bodies or tribunals in any matter affecting the performance under this Agreement, including, without limitation, workers' compensation laws, antidiscrimination laws, environmental laws, minimum and maximum salary and wage statutes and regulations, health and safety codes, licensing laws and regulations, the CTRMA's enabling legislation (Chapter 370 of the Texas Transportation Code), other applicable portions of the Texas Transportation Code, and all amendments and modifications to any of the foregoing, if any. The Contractor shall also comply with the CTRMA's policies and procedures provided to the Contractor or which are generally available to the public related to operational and administrative matters, such as, but not limited to, security of and access to the CTRMA information and facilities. When requested, the Contractor shall furnish the CTRMA with satisfactory proof of compliance with said laws, statutes, ordinances, rules, regulations, codes, orders, judgements, and decrees above specified.

As part of their operations, the CTRMA, and other toll authorities to whom services may be provided collect and maintain information about individuals (including toll customers, vehicle owners, and employees) that may include data such as a license-plate number, geolocation or travel data, employment-related information, or login and password credentials (all such data pertaining to individuals, whether or not specifically listed, being "Personal Information"). As part of its performance of the Services, Contractor may have access to, handle, or receive Personal Information or other confidential or proprietary materials, information, or data maintained by or concerning the CTRMA, and other toll authorities to whom services may be provided (collectively with Personal Information, "RMA Information"). Contractor therefore agrees that:

a. Contractor is responsible for the security of RMA Information that it receives or accesses in performing Services, and Contractor shall at all times maintain appropriate information-security measures with respect to RMA Information in a manner consistent with applicable law.

b. Contractor must implement and maintain current and appropriate administrative, technical, and physical safeguards with respect to RMA Information in its possession, custody, or control, or to which it has access, to protect against unauthorized access or use of such RMA Information. At a minimum, such safeguards shall be consistent with generally-recognized best practices for information security in the handling of similar types of data. Without limiting the foregoing, Contractor must appropriately and effectively encrypt RMA Information (i) transmitted over the Internet, other public networks, or wireless networks, and (ii) stored on laptops, tablets, or any other removable or portable media or devices.

c. Contractor must identify to the CTRMA all subcontractors, consultants, and other persons who may have access to RMA Information in connection with the Services. Contractor must restrict the RMA Information to which a given employee or approved subcontractor has access to only that RMA Information which such employee or approved subcontractor needs to access in the course of such employee's or approved subcontractor's duties and responsibilities in connection with the Services.

d. Before granting access to RMA Information, Contractor must ensure that its employees and each approved subcontractor agrees to abide by these information security measures (or other applicable measures that are at least as protective of RMA Information).

e. Absent the CTRMA's advance written permission, RMA Information must not be stored, accessed, or processed at any location outside of the United States.

f. Contractor may use RMA Information only for performing the Services, and Contractor must ensure that its employees and approved subcontractor are restricted from any use of RMA Information other than for such purpose.

g. Except to the extent otherwise expressly permitted, Contractor may not disclose RMA Information except as required by law or a governmental authority having jurisdiction over Contractor. In the event of such required disclosure, Contractor must notify the CTRMA in advance (if legally permissible to do so) and reasonably cooperate with any decision by the CTRMA to seek to condition, minimize the extent of, or oppose such disclosure.

h. Contractor will immediately notify the CTRMA if Contractor discovers any actual or reasonably suspected breach of security or unauthorized use of RMA Information (i) in the possession, custody, or control of Contractor, its employees, or its subcontractors and/or (ii) effectuated using access permissions or credentials extended to an employee or subcontractor of Contractor (either of occurrences (i) or (ii) being referred to as a "Security Incident"). In no event shall Contractor's notification to the CTRMA be later than three (3) days after Contractor discovers the Security Incident; provided, however, that more immediate notification shall be given as the circumstances warrant or if more immediate notification is required by law. Contractor must provide all necessary and reasonable cooperation with respect to the investigation of such Security Incident, including the exchange of pertinent details (such as log files). In addition, Contractor must promptly undertake appropriate remediation measures and inform the CTRMA regarding the same.

i. Subject to requirements of data security or privacy laws, the CTRMA, in its sole discretion, will determine whether, and when to provide notice of a Security Incident to (a) any individuals whose personal information has been actually or potentially compromised; (b) any governmental authority; and/or (c) any other entity, including, but not limited to, consumer credit reporting agencies or the media. All notices must be approved by the CTRMA before they are distributed. Contractor must reimburse the CTRMA for costs or expenses the CTRMA incurs in connection with such notices (including the provision of credit monitoring or other identity protection services, to the extent the provision of such services is legally required or customary for similar data security incidents). Furthermore, and in addition to any other indemnification requirements under this Agreement, Contractor shall indemnify and hold the CTRMA harmless from all claims, costs, expenses, and damages (including reasonable attorneys' fees) that the CTRMA incurs in connection with any regulatory action or third-party claim arising from a Security Incident.

j. Contractor must cooperate and permit the CTRMA (and any governmental authorities with jurisdiction in connection with an audit requested by the CTRMA) reasonable access for on-site review of Contractor's data security systems and procedures to verify Contractor's compliance with its obligations under this Addendum.

k. Contractor must provide a "SOC 1 Type 2" Report or a SOC 1 readiness assessment within two hundred seventy (270) days of the Effective Date, and a SOC 1 Type 2 Report for all subsequent submittals required under this subsection 16.k. Submittals under this subsection 16.k shall be performed by a U.S. audit firm, approved by the CTRMA, in accordance with the American Institute of Certified Public Accountants (AICPA) Professional Standards AT-C Section 320. The scope of each report must include all of Contractor's applications and systems that have access to or are involved in the processing of RMA Information, and each report must include a list of the controls that were tested.

The final audited SOC 1 Type 2 Report must be delivered to the CTRMA no later than May 31st of the then current year, covering the period of April 1 (of the prior year) through March 31 (of the current year). A bridge letter must be delivered to the CTRMA no later than June 30th of the then current year, covering the period April 1 (of the current year) through June 30 (of the current year), which will include a representation from Contractor about changes to the SOC 1 Type 2 controls, including information about changes in the design or effectiveness of the controls.

The CTRMA must approve (i) the planned control objectives prior to commencement of the first SOC 1 Type 2 report and (ii) any planned changes to the scope or timing of the SOC 1 Type 2. Contractor shall notify the CTRMA of any potential report qualification(s) of the audit opinion as soon as practicable but no later than ten (10) business days prior to delivery of the final SOC 1 Type 2 report.

l. Whenever RMA Information is no longer needed for the performance of Services, or at any time upon written notification from the CTRMA, Contractor must unconditionally and without any charge or fee return or, at the CTRMA's written election, certify the secure destruction of, all RMA Information in Contractor's possession, custody, or control (including RMA

Information in the possession, custody, or control of any of Contractor's subcontractors or consultants).

m. Contractor must cooperate and permit the CTRMA's back office service provider reasonable access to all RMA Information in Contractor's possession, custody, or control (including RMA Information in the possession, custody, or control of any of Contractor's subcontractors or consultants) in connection with any PCI DSS compliance audits.

ARTICLE 17 **AUTHORITY INDEMNIFIED**

THE CONTRACTOR SHALL INDEMNIFY AND SAVE HARMLESS THE CTRMA AND ITS OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, AND CONTRACTORS FROM ANY CLAIMS, COSTS OR LIABILITIES OF ANY TYPE OR NATURE AND BY OR TO ANY PERSONS WHOMSOEVER, ARISING FROM THE CONTRACTOR'S ACTS, ERRORS OR OMISSIONS WITH RESPECT TO THE CONTRACTOR'S PERFORMANCE OF THE WORK TO BE ACCOMPLISHED UNDER THIS AGREEMENT, WHETHER SUCH CLAIM OR LIABILITY IS BASED IN CONTRACT, TORT OR STRICT LIABILITY. IN SUCH EVENT, THE CONTRACTOR SHALL ALSO INDEMNIFY AND SAVE HARMLESS THE CTRMA, ITS OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, AND CONTRACTORS (COLLECTIVELY THE "INDEMNIFIED PARTIES") FROM ANY AND ALL EXPENSES, INCLUDING REASONABLE ATTORNEYS' FEES, INCURRED BY THE CTRMA OR ANY OF THE INDEMNIFIED PARTIES IN LITIGATING OR OTHERWISE RESISTING SAID CLAIMS, COSTS OR LIABILITIES. IN THE EVENT THE CTRMA, ITS OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, OR CONTRACTORS IS/ARE FOUND TO BE PARTIALLY AT FAULT, THE CONTRACTOR SHALL, NEVERTHELESS, INDEMNIFY THE CTRMA OR ANY OF THE INDEMNIFIED PARTIES FROM AND AGAINST THE PERCENTAGE OF FAULT ATTRIBUTABLE TO THE CONTRACTOR, ITS OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, SUB CONSULTANTS, AND CONTRACTORS OR TO THEIR CONDUCT.

ARTICLE 18 **CONFLICTS OF INTEREST**

The Contractor represents and warrants to the CTRMA, as of the effective date of this Agreement and throughout the term hereof, that it, its employees and subcontractors (a) have no financial or other beneficial interest in any contractor, engineer, product or service evaluated or recommended by the Contractor, except as expressly disclosed in writing to the CTRMA, (b) shall discharge their responsibilities under this Agreement professionally, impartially and independently, and (c) are under no contractual or other restriction or obligation, the compliance with which is inconsistent with the execution of this Agreement or the performance of their respective obligations hereunder. In the event that a firm (individually or as a member of a consortium) submits a proposal to work for the CTRMA, the Contractor shall comply with the CTRMA's conflict of interest policies and shall make disclosures as if it were one of the key personnel designated under such policies.

ARTICLE 19 INSURANCE

Prior to beginning the Services designated in this Agreement, the Contractor shall obtain and furnish certificates to the CTRMA for the following minimum amounts of insurance:

a. **WORKERS' COMPENSATION INSURANCE.** In accordance with the laws of the State of Texas covering all of Contractor's employees and employer's liability coverage with a limit of not less than \$1,000,000. A "Waiver of Subrogation" in favor of the CTRMA shall be provided.

b. **COMMERCIAL GENERAL LIABILITY INSURANCE.** On an "occurrence basis" with limit a limit of not less than \$1,000,000 combined single limit per occurrence for bodily injury, including those resulting in death; and property damage on an "occurrence basis" with an aggregate limit of not less than \$2,000,000. A "Waiver of Subrogation" in favor of the CTRMA shall be provided.

c. **BUSINESS AUTOMOBILE LIABILITY INSURANCE.** Applying to owned, non-owned, and hired automobiles in an amount not less than \$1,000,000 for bodily injury, including death, to anyone person, and for property damage on account of anyone occurrence. The policy shall insure any vehicle used in connection with the Contractor's obligations under this Agreement. A "Waiver of Subrogation" in favor of the CTRMA shall be provided.

d. **VALUABLE PAPERS INSURANCE.** With limits not less than \$500,000 to cover the full restoration of any records, information, logs, reports, diaries, or other similar data or materials of Contractor relating to the Services provided under this Agreement in the event of their loss or destruction, until such time as the work has been delivered to the CTRMA or otherwise completed.

e. **PROFESSIONAL/CYBERSECURITY INSURANCE.** Professional errors and omissions liability insurance, including liability for financial loss and/or business interruption suffered by the CTRMA, due to error, omission, negligence of employees and machine malfunction in connection with all Services provided by Contractor, in an amount of at least \$40,000,000;

Technology cyber liability insurance, including liability for financial loss and/or business interruption suffered by the CTRMA, due to cyber liability/network security/privacy coverage arising from errors, omission, negligence of employees and hardware malfunction, or causing electronic data to be inaccessible, computer viruses, denial of service, loss of service, network risks (such as data breaches, unauthorized access or use, identity theft, invasion of privacy, damage/loss/theft of data, degradation, downtime, etc.) in connection with all Services provided by Contractor, in an amount of at least twenty million dollars (\$20,000,000), and which has no exclusion or restriction for encrypted or unencrypted portable devices.

f. **EXCESS UMBRELLA LIABILITY.** With minimum limits of \$6,000,000 per claim and in the aggregate, annually, as applicable excess of the underlying policies required at a. - c. above. The Umbrella Policy shall contain the provision that it will continue in force as an underlying insurance in the event of exhaustion of underlying aggregate policy limits.

g. **EMPLOYEE DISHONESTY INSURANCE.** Coverage for employee dishonesty, loss of money and other property belonging to the CTRMA resulting directly from a fraudulent or

dishonest act by an agent or employee of the Contractor while performing the Services, with limits of not less than \$10,000,000 per claim.

h. **GENERAL FOR ALL INSURANCE.** The Contractor shall promptly, upon execution of this Agreement, furnish certificates of insurance to the CTRMA indicating compliance with the above requirements. Certificates shall indicate the name of the insured, the name of the insurance company, the name of the agency/agent, the policy number, the term of coverage, and the limits of coverage.

All policies are to be written through companies (a) registered to do business in the State of Texas; (b) rated: (i), with respect to the companies providing the insurance under subsections 19.a. through e. and 19.g., above, by A. M. Best Company as “A-X” or better (or the equivalent rating by another nationally recognized rating service) and (ii) with respect to the company providing the insurance under subsection 19.f., a rating by A. M. Best Company or similar rating service satisfactory to the CTRMA and/or its insurance consultant; and (c) otherwise acceptable to the CTRMA.

All policies are to be written through companies registered to do business in the State of Texas. Such insurance shall be maintained in full force and effect during the life of this Agreement or for a longer term as may be otherwise provided for hereunder. Insurance furnished under subsections 19.b., c., d., e. f, and g. above, shall name the CTRMA as additional insureds and shall protect the CTRMA, the Contractor, their officers, employees, directors, agents, and representatives from claims for damages for bodily injury and death and for damages to property arising in any manner from the negligent or willful wrongful acts or failures to act by the Contractor, its officers, employees, directors, agents, and representatives in the performance of the Services rendered under this Agreement. Applicable Certificates shall also indicate that the contractual liability assumed in Article 17, above, is included.

The insurance carrier shall include in each of the insurance policies required under subsections 19.a., b., c., d., e., f, and g. the following statement: “This policy will not be canceled or non-renewed during the period of coverage without at least thirty (30) days prior written notice addressed to the Central Texas Regional Mobility Authority, 3300 N. IH 35, Suite 300, Austin, TX 78705, Attention: Executive Director.”

ARTICLE 20 **COORDINATION OF CONTRACT DOCUMENTS**

The Proposal dated June 18, 2021 submitted by the Contractor in response to the RFP and Best and Final Offer, dated October 1, 2021, are attached hereto and incorporated herein as Appendix “H” for all purposes (collectively, the “Proposal”). In the event of a conflict, the order of prevailing precedence (a-highest order to d-lowest order of precedence) shall be as follows:

- (a) Any amendments to the Agreement.
- (b) The Agreement.
- (c) Appendices to the Agreement.

- (d) Work Authorizations Issued by the CTRMA
- (e) The Contractor's Proposal.

However, if the Proposal can reasonably be interpreted as providing higher quality materials or services than those required by the other contract documents or otherwise contains offers, statements or terms more advantageous to the CTRMA, Contractor's obligations under the Agreement shall include compliance with all such statements, offers and terms contained in the Proposal

ARTICLE 21 **MAINTENANCE OF, ACCESS TO, AND AUDIT OF RECORDS**

a. **RETENTION AND AUDIT OF RECORDS.** Contractor shall maintain at its offices in Austin, Texas, a complete set of all books, records, electronic files and other documents prepared or employed by Contractor in its management, scheduling, cost accounting and other activities related to this Agreement. Contractor shall maintain all records and documents relating to this Agreement, including copies of all original documents, or electronic copies of such documents if approved by the CTRMA, delivered to the CTRMA until four (4) years after the date of the termination of this Agreement, or such period as is required by Texas law, whichever is longer. Contractor shall notify the CTRMA where such records and documents are kept. If approved by the CTRMA, photographs, microphotographs or other authentic reproductions may be maintained instead of original records and documents.

Contractor shall make these records and documents available for audit and inspection to the CTRMA, at the CTRMA's offices in Austin, Texas, at all reasonable times, without charge, and shall allow the CTRMA or its representatives to make copies of such documents. The CTRMA may direct its own auditors or representatives to perform such audits or reviews. Contractor shall cooperate fully with the entity performing the audit or review.

Notwithstanding the foregoing, the Contractor shall comply with all laws pertaining to the retention of records and the provision of access thereto. The Contractor shall maintain its books and records in accordance with generally accepted accounting principles in the United States, subject to any exceptions required by existing bond indentures of the CTRMA, and shall provide the CTRMA with a copy of any audit of those books and records as provided herein or otherwise requested by the CTRMA.

b. **PUBLIC INFORMATION ACT.** Contractor acknowledges and agrees that all records, documents, drawings, plans, specifications and other materials in the CTRMA's possession, including materials submitted by Contractor, are subject to the provisions of Chapter 552, Texas Government Code (the "Public Information Act"). Contractor shall be solely responsible for all determinations made by it under such law, and for clearly and prominently marking each and every page or sheet of materials with "Trade Secret" or "Confidential", as it determines to be appropriate. Contractor is advised to contact legal counsel concerning such law and its application to Contractor.

If any of the materials submitted by the Contractor to the CTRMA are clearly and prominently labeled "Trade Secret" or "Confidential" by Contractor, the CTRMA will endeavor

to advise Contractor of any request for the disclosure of such materials prior to making any such disclosure. Under no circumstances, however, will the CTRMA be responsible or liable to Contractor or any other person for the disclosure of any such labeled materials, whether the disclosure is required by law, or court order, or occurs through inadvertence, mistake or negligence on the part of the CTRMA.

In the event of litigation concerning the disclosure of any material marked by Contractor as “Trade Secret” or “Confidential,” the CTRMA’s sole obligation will be as a stakeholder retaining the material until otherwise ordered by a court, and Contractor shall be fully responsible for otherwise prosecuting or defending any action concerning the materials at its sole cost and risk; provided, however, that the CTRMA reserves the right, in its sole discretion, to intervene or participate in the litigation in such manner as it deems necessary or desirable. All costs and fees, including attorneys’ fees and costs, incurred by the CTRMA in connection with any litigation, proceeding or request for disclosure shall be reimbursed and paid by Contractor.

i. Compliance with Subchapter J of the Public Information Act. The requirements of Subchapter J of the Public Information Act may apply to this Agreement, and the Contractor agrees that the Agreement can be terminated if the Contractor knowingly or intentionally fails to comply with a requirement of that subchapter.

Notwithstanding any other provision of the Agreement, within five (5) business days of a request by the CTRMA, the Contractor shall provide any records related to this Agreement that are in the custody or possession of the Contractor that are subject to a pending request for information received by the CTRMA.

Not later than 180 days following the completion of the term of this Agreement, or as specified in the succession plan upon the termination of the Agreement, the Contractor shall provide the CTRMA with all records related to this Agreement in the custody or possession of the Contractor. The cost of complying with this subsection 21.b.i. is not subject to reimbursement by the CTRMA.

ARTICLE 22 **RELATIONSHIP BETWEEN THE PARTIES**

Notwithstanding the anticipated collaboration between the parties hereto, or any other circumstances, the relationship between the CTRMA and the Contractor shall be one of an independent contractor. The Contractor acknowledges and agrees that neither it nor any of its employees or subcontractors, shall be considered an employee of the CTRMA for any purpose. The Contractor shall have no authority to enter into any contract binding upon the CTRMA, or to create any obligation on behalf of the CTRMA. As an independent contractor, neither the Contractor nor its employees shall be entitled to any insurance, pension, or other benefits customarily afforded to employees of the CTRMA. Under no circumstances shall the Contractor, or its employees, or subcontractors, represent to suppliers, contractors or any other parties that it is employed by the CTRMA or serves the CTRMA in any capacity other than as an independent contractor. The Contractor shall clearly inform all suppliers, Contractors and others that it has no authority to bind the CTRMA. Nothing contained in this Agreement shall be deemed or construed to create a partnership or joint venture, to create the relationship of employee-employer or

principal-agent, or to otherwise create any liability for the CTRMA whatsoever with respect to the liabilities, obligations or acts of the Contractor, its employees, subcontractors, or any other person.

ARTICLE 23
DELIVERY OF NOTICES, ETC.

In each instance under this Agreement in which one party is required or permitted to give notice to the other, such notice shall be deemed given either (a) when delivered by hand; (b) one (1) business day after being deposited with a reputable overnight air courier service; or (c) three (3) business days after being mailed by United States mail, registered or certified mail, return receipt requested, and postage prepaid. Any notices provided under this Agreement must be sent or delivered to:

In the case of the Contractor:

Electronic Transaction Consultants, LLC
2600 N. Collins. Blvd, Suite 4000
Richardson, Texas 75080
Attn: General Counsel

In the case of the CTRMA:

Central Texas Regional Mobility Authority
3300 N IH-35, Suite 300
Austin, TX 78705
Attn: Director of Operations

and:

Central Texas Regional Mobility Authority
3300 N IH-35, Suite 300
Austin, TX 78705
Attn: General Counsel

Either party hereto may from time to time change its address for notification purposes by giving the other party prior written notice of the new address and the date upon which it will become effective.

ARTICLE 24
REPORTING OF SUBPOENAS, NOTICES, ETC.

The Contractor shall immediately send the CTRMA a copy of any summons, subpoena, notice, or other documents served upon the Contractor, its agents, employees, subcontractors, or representatives, or received by it or them, in connection with any matter related to the Services under this Agreement.

ARTICLE 25
AUTHORITY'S ACTS

Anything to be done under this Agreement by the CTRMA may be done by such persons, corporations, firms, or other entities as the CTRMA may designate.

ARTICLE 26
LIMITATIONS

Notwithstanding anything herein to the contrary, all covenants and obligations of the CTRMA under this Agreement shall be deemed to be valid covenants and obligations only to the extent authorized by Chapter 370 of the Texas Transportation Code and permitted by the laws and the Constitution of the State of Texas, and no officer, director, or employee of the CTRMA shall have any personal obligations or liability thereunder or hereunder.

The Contractor is obligated to comply with applicable standards of professional care in the performance of the Services. The CTRMA shall have no obligation to verify any information provided to the Contractor by the CTRMA or any other person or entity.

ARTICLE 27
CAPTIONS NOT A PART HEREOF

The captions or subtitles of the several articles, subsections, and divisions of this Agreement are inserted only as a matter of convenience and for reference, and in no way define, limit or describe the scope of this Agreement or the scope or content of any of its articles, subsections, divisions, or other provisions.

ARTICLE 28
CONTROLLING LAW, VENUE

This Agreement shall be governed and construed in accordance with the laws of the State of Texas. The parties hereto acknowledge that venue is proper in Travis County, Texas, for all disputes arising hereunder and waive the right to sue and be sued elsewhere.

ARTICLE 29
COMPLETE AGREEMENT

This Agreement, including all Appendices attached hereto, sets forth the complete agreement between the parties with respect to the Services and supersedes all other agreements (oral or written) with respect thereto. Capitalized terms shall have the definitions provided herein. Any changes in the character, agreement, terms and/or responsibilities of the parties hereto must be enacted through a written amendment. No amendment to this Agreement shall be of any effect unless in writing and executed by the CTRMA and the Contractor. Notwithstanding the foregoing, the Parties acknowledge that the Business Rules contained in Appendix "A", are of a nature that requires continuous revisions throughout the term of this Agreement and that such revisions are not required to be evidenced by a written amendment executed by the Parties. This Agreement may not be orally canceled, changed, modified or amended, and no cancellation, change,

modification or amendment shall be effective or binding, unless in writing and signed by the parties to this Agreement. This provision cannot be waived orally by either party.

ARTICLE 30
TIME OF ESSENCE

With respect to any specific delivery or performance date or other deadline provided hereunder, time is of the essence in the performance of the provisions of this Agreement. The Contractor acknowledges the importance to the CTRMA of the timely provision of the Services and will perform its obligations under this Agreement with all due and reasonable care.

ARTICLE 31
SEVERABILITY

If any provision of this Agreement, or the application thereof to any person or circumstance, is rendered or declared illegal for any reason and shall be invalid or unenforceable, the remainder of this Agreement and the application of such provision to other persons or circumstances shall not be affected thereby but shall be enforced to the greatest extent permitted by applicable law.

ARTICLE 32
AUTHORIZATION

Each party to this Agreement represents to the other that it is fully authorized to enter into this Agreement and to perform its obligations hereunder, and that no waiver, consent, approval, or authorization from any third party is required to be obtained or made in connection with the execution, delivery, or performance of this Agreement.

ARTICLE 33
SUCCESSORS

This Agreement shall be binding upon and inure to the benefit of the CTRMA, the Contractor, and their respective heirs, executors, administrators, successors, and permitted assigns. The Contractor may not assign the Agreement or any portion thereof without the prior written consent of the CTRMA.

ARTICLE 34
INTERPRETATION

No provision of this Agreement shall be construed against or interpreted to the disadvantage of any party by any court, other governmental or judicial authority, or arbiter by reason of such party having or being deemed to have drafted, prepared, structured, or dictated such provision.

ARTICLE 35
BENEFITS INURED

This Agreement is solely for the benefit of the parties hereto and their permitted successors and assigns. Nothing contained in this Agreement is intended to, nor shall be deemed or construed to, create or confer any rights, remedies, or causes of action in or to any other persons or entities, including the public in general. Notwithstanding the foregoing, the Contractor acknowledges that the Services provided for hereunder may be made available to other toll authorities through agreements between the CTRMA and those entities, and that Contractor is required to perform for those entities in a manner which complies with the requirements and obligations of this Agreement. The CTRMA shall have the right to enforce this Agreement against Contractor on behalf of other entities to which the Services are being provided.

ARTICLE 36
SURVIVAL

The parties hereby agree that each of the provisions in the Agreement are important and material and significantly affect the successful conduct of the business of the CTRMA, as well as its reputation and goodwill. Any breach of the terms of this Agreement is a material breach of this Agreement, from which the Contractor may be enjoined and for which the Contractor also shall pay to the CTRMA all damages which arise from said breach. The Contractor understands and acknowledges that the Contractor's responsibilities under Articles 13, 16 and 17 of this Agreement shall continue in full force and effect after the Contractor's contractual relationship with the CTRMA ends for any reason.

ARTICLE 37
FORCE MAJEURE

If a Force Majeure Event occurs, the Nonperforming Party is excused from performance of its obligations under this Agreement but only for the time and to the extent that such performance is prevented by the Force Majeure Event. During a Force Majeure Event that prevents Contractor from delivering Services, Contractor's entitlement to compensation under this Agreement is suspended.

When the Nonperforming Party is able to resume performance of its obligations under this Agreement, it will immediately give the Performing Party (defined below) written notice to that effect and promptly resume performance under this Agreement.

The relief offered by this Force Majeure provision is the exclusive remedy available to the Nonperforming Party with respect to a Force Majeure Event.

The Performing Party may terminate this Agreement if:

- (a) the Nonperforming Party's failure to perform under this Agreement due to a Force Majeure Event impairs material benefits of this Agreement to the other party (the "Performing Party"); and

- (b) the Nonperforming Party does not resume performance in accordance with this Agreement within thirty (30) days following the giving of notice to the Nonperforming Party of the Performing Party’s intent to terminate this Agreement.

In this Agreement, “Force Majeure Event” means any act, event, or condition not foreseeable by a party (the “Nonperforming Party”) that: (A) prevents the Nonperforming Party from performing its obligations under this Agreement; (B) is beyond the control of, not caused in whole or in part by, and not otherwise the fault of the Nonperforming Party; and (C) is not able to be overcome or avoided by the Nonperforming Party’s exercise of diligence or preventative measures. Notwithstanding the foregoing, Force Majeure Events shall be limited to the following: any earthquake, tornado, hurricane, flood or other natural disaster, fire, freight embargo, strike, blockade, rebellion, war, riot, act of sabotage or civil commotion. The following do not constitute a Force Majeure Event: economic hardship, changes in market conditions, or insufficiency of funds.

ARTICLE 38
DISPUTE RESOLUTION

The parties have established an issues resolution ladder in order to resolve disputes expeditiously and effectively at appropriate organizational levels of each party. In the event of any dispute whatsoever arising out of or relating to this Agreement, the disputing party must submit a written notice of the dispute to the Tier 1 designee of the other party shown in the issues resolution ladder below. The notice must state clearly, and in detail, the good faith basis for the dispute. Disputes shall be considered as quickly as possible, taking into consideration the particular circumstances and the time required to prepare detailed documentation. Steps may be omitted as agreed by both parties, and the time periods stated below may be shortened in order to hasten resolution.

Issues Resolution Ladder

<i>Tier</i>	<i>Contractor</i>		<i>CTRMA</i>	<i>Time Limit*</i>
1	Project Manager	and	CTRMA Assistant Director of IT and Toll Systems	10 days
2	Account Vice President	and	CTRMA Director of Operations	10 days
3	Chief Financial Officer	and	CTRMA Executive Director	10 days

** Time (in calendar days) in which dispute must be resolved or passed on to the next tier.*

If a dispute is processed under the issues resolution ladder and not resolved, the parties may attempt to resolve the dispute through mediation, using a mediator mutually agreed upon by the Contractor and the CTRMA, prior to initiating litigation.

At all times during this dispute resolution process or any subsequent administrative, mediation or court proceeding, the Contractor shall proceed with the provision of the Services, without delay, in accordance with this Agreement, and as directed by the CTRMA through a Work Authorization. The Contractor acknowledges that it shall be solely responsible for any delay that results from its actions or inactions during the dispute resolution process, even if the Contractor's position in connection with the dispute ultimately prevails.

ARTICLE 39
CONTRACTOR CERTIFICATIONS

a. **Entities that Boycott Israel.** The Contractor represents and warrants that (1) it does not, and shall not for the duration of this Agreement, boycott Israel or (2) the verification required by Section 2271.002 of the Texas Government Code does not apply to this Agreement. If circumstances relevant to this provision change during the course of the contract, the Contractor shall promptly notify the CTRMA.

b. **Entities that Boycott Energy Companies.** The Contractor represents and warrants that: (1) it does not, and will not for the duration of this Agreement, boycott energy companies or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to this Agreement. If circumstances relevant to this provision change during the course of this Agreement, the Contractor shall promptly notify the CTRMA.

c. **Entities that Discriminate Against Firearm Entities or Trade Associations.** The Contractor verifies that: (1) it does not, and will not for the duration of this Agreement, have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to this Agreement. If circumstances relevant to this provision change during the course of this Agreement, the Contractor shall promptly notify the CTRMA.

[Remainder of Page Intentionally Left Blank]

IN WITNESS WHEREOF, the parties have executed this Agreement effective on the date and year first written above.

CONTRACTOR: **ELECTRONIC TRANSACTION CONSULTANTS, LLC**

By: _____
Name: David Mace Roberts
Title: General Counsel and Compliance Officer

CTRMA: **CENTRAL TEXAS REGIONAL MOBILITY
AUTHORITY**

By: _____
Name: James Bass
Title: Executive Director

APPENDIX A
Scope of Services



CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

Restated Agreement – December 14, 2022

**Agreement for
Electronic Toll Collection System
Integration and Maintenance Services**

Appendix 2

Scope of Work

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2 SCOPE OF WORK

The following sections provide information regarding the Scope of Work for the project.

2.1 BACKGROUND

2.1.1 Current Facilities

CTRMA currently operates five (5) All-Electronic Toll (AET) facilities and one (1) Express Lane facility in the Austin area, as shown in Figure 2-1. Historical transaction data for each facility can be found at <https://www.mobilityauthority.com/business/financial/fin-inv-info>. The most recent traffic and revenue projections for each operating facility are included in Appendix 15, Traffic Projections.



Figure 2-1: CTRMA Facility Map

2.1.1.1.1 183A Toll Road

The 183A Toll Road is an 11.6-mile toll road extending from northwest Austin through Cedar Park and Leander in northwest Williamson County (Figure 2-2). The facility consists of tolled mainlines with non-tolled frontage roads at the north end (Figure 2-3). Phase II was completed in 2012, more than seven years ahead of schedule, and plans for Phase III are under development to extend the toll road from its current terminus at Hero Way northward to SH 29.



Figure 2-2: 183A Toll Road Project Map

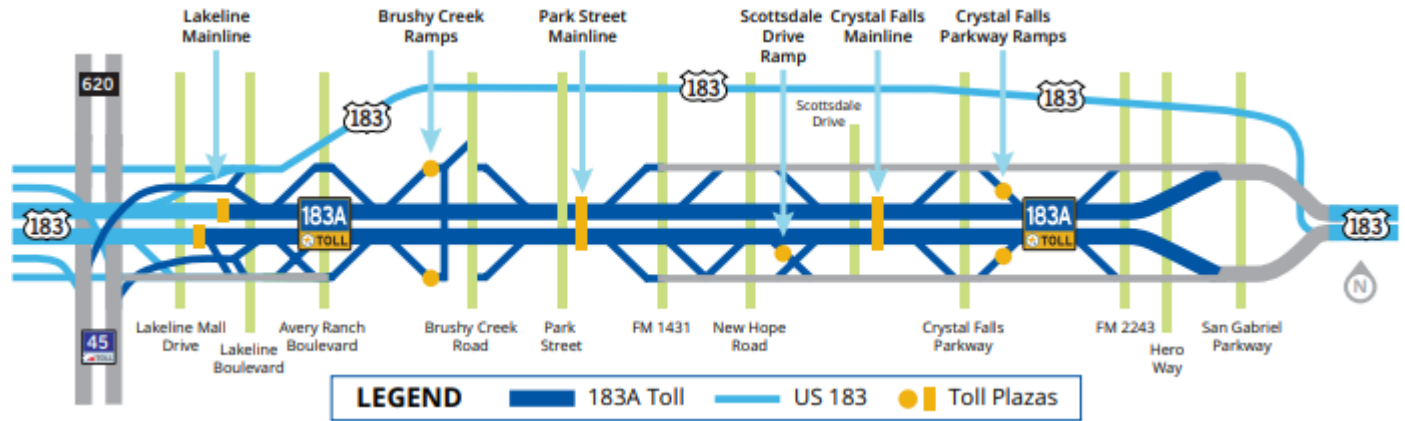


Figure 2-3: 183A Toll Road Project Configuration

2.1.1.2 290 Toll Road

The 290 Toll Road is a 6.2-mile toll road that includes three tolled lanes and three non-tolled general-purpose lanes in each direction from US 183 to the east of Parmer Lane (Figure 2-4). The US 290 facility was upgraded, effectively tripling capacity while preserving the non-tolled lane (Figure 2-5). The 290 toll road links up with important roadways in the region, including US 183 and SH 130, and features a ten-foot-wide, six-mile shared-use path for pedestrians and cyclists.



Figure 2-4: 290 Toll Road Project Map

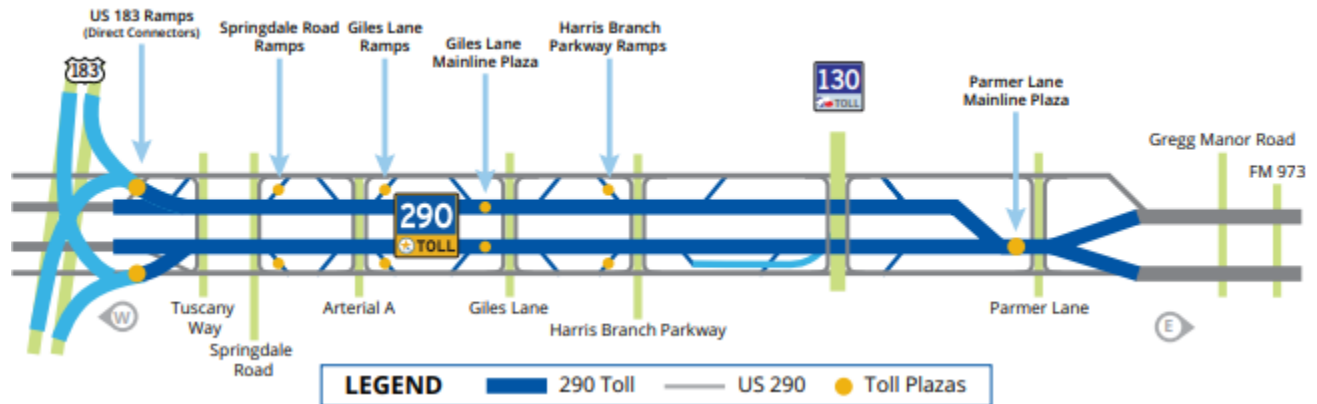


Figure 2-5: 290 Toll Road Project Configuration

2.1.1.3 MoPac Express Lane

The MoPac Express Lane gives drivers the option to bypass congestion on the 11-mile stretch of MoPac between Parmer Lane and Cesar Chavez Street (Figure 2-6). As a primary alternative to I-35, MoPac carries more than 180,000 cars and trucks each day. Estimates project that by 2035, MoPac shall serve more than 220,000 vehicles a day.

The Express Lane is dynamically priced and located in the middle of the MoPac corridor, separated from the existing lanes by a four to five-foot-wide striped buffer zone with flexible plastic sticks. Drivers can access the MoPac Express Lane at Cesar Chavez Street, Far West Boulevard, RM 2222, or Parmer Lane.

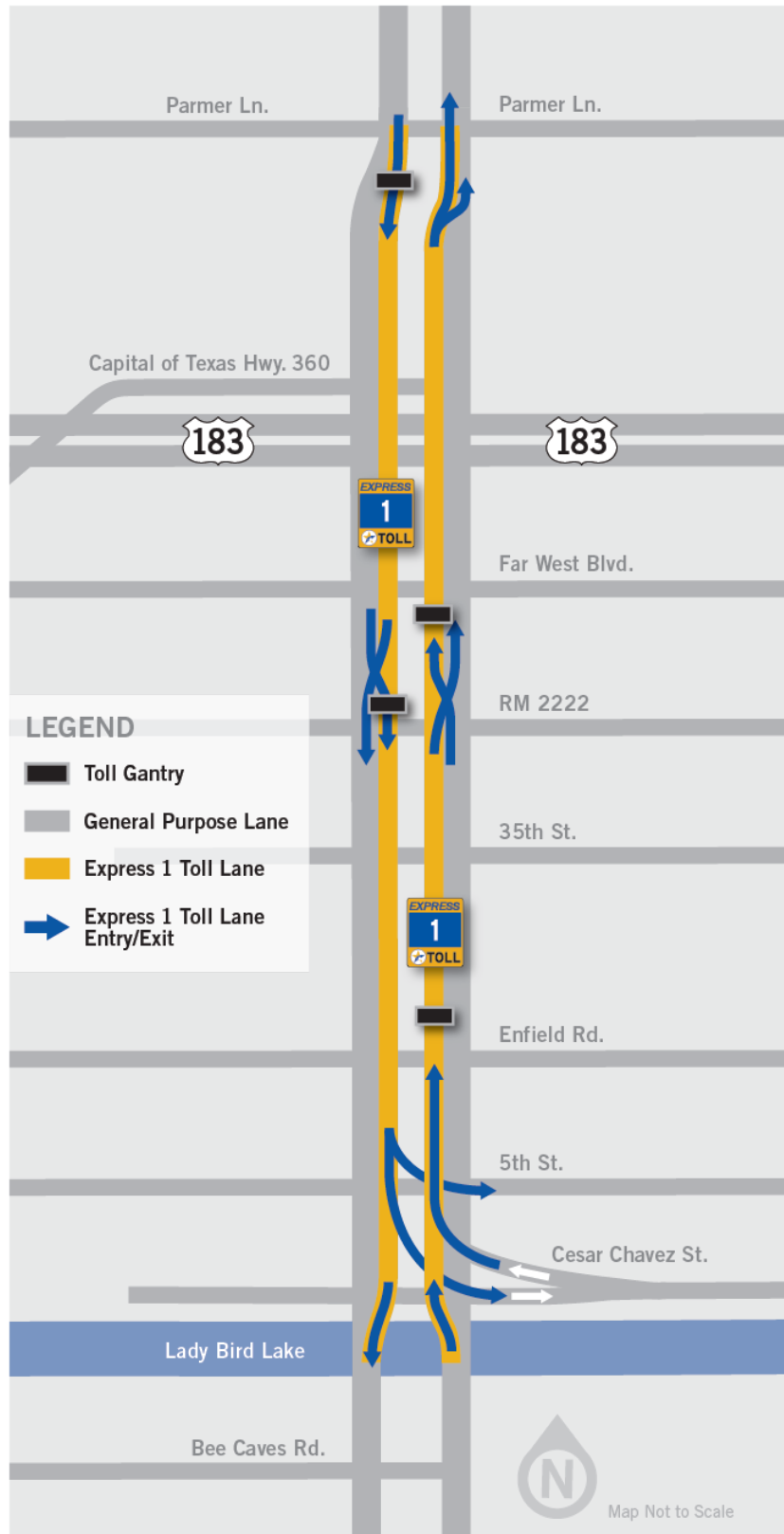


Figure 2-6: MoPac Express Lane Project Map and Configuration

2.1.1.4 71 Toll Lane

The 71 Toll Lane project added a toll lane in each direction alongside of SH 71, beginning at Presidential Boulevard at Austin-Bergstrom International Airport (AUS) and extending east near SH 130 (Figure 2-7). These new lanes offer a free-flowing and reliable bypass route for through-traffic on SH 71, a major corridor connecting drivers to AUS, the city of Bastrop, and beyond.



Figure 2-7: 71 Toll Lane Project Configuration

2.1.1.5 45SW Toll Road

The 45SW Toll Road is a new facility that connects MoPac and FM 1626, bringing relief to the rapidly growing area of southern Travis and northern Hays counties (Figure 2-8). The 45SW Toll Road includes two tolled lanes in each direction (Figure 2-9). The 45SW Toll Road does not contain frontage roads, therefore limiting impacts to the surrounding environment.

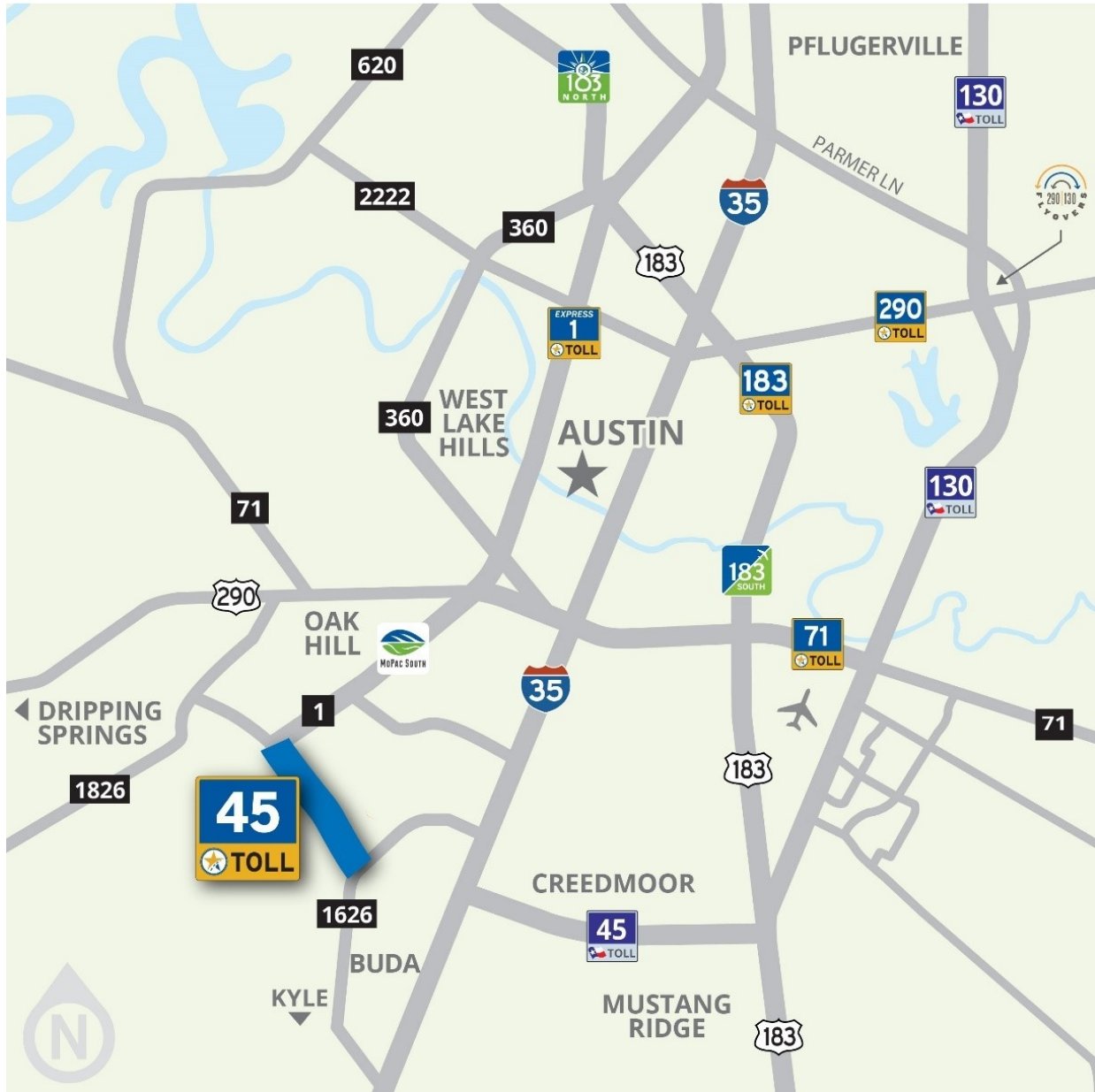


Figure 2-8: 45SW Toll Road Project Map



Figure 2-9: 45SW Toll Road Project Configuration

2.1.1.6 183 South Toll Road (North End)

The 183 South project is adding three tolled lanes in each direction on an 8-mile stretch of US 183 between US 290 and SH 71 (Figure 2-10). The northern half of the project between US 290 and Techni Center Drive is now open to traffic (Figure 2-11). Phase II open in January 2021.

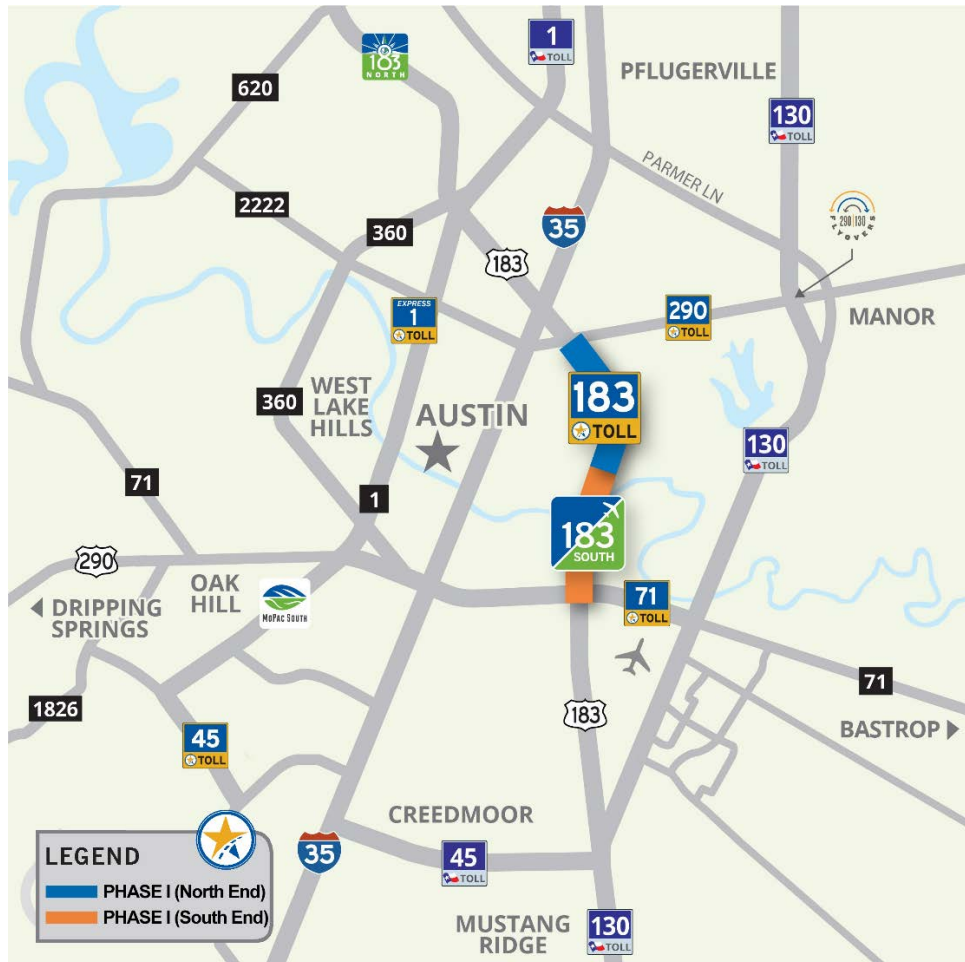


Figure 2-10: 183 South Toll Road (North End) Project Map

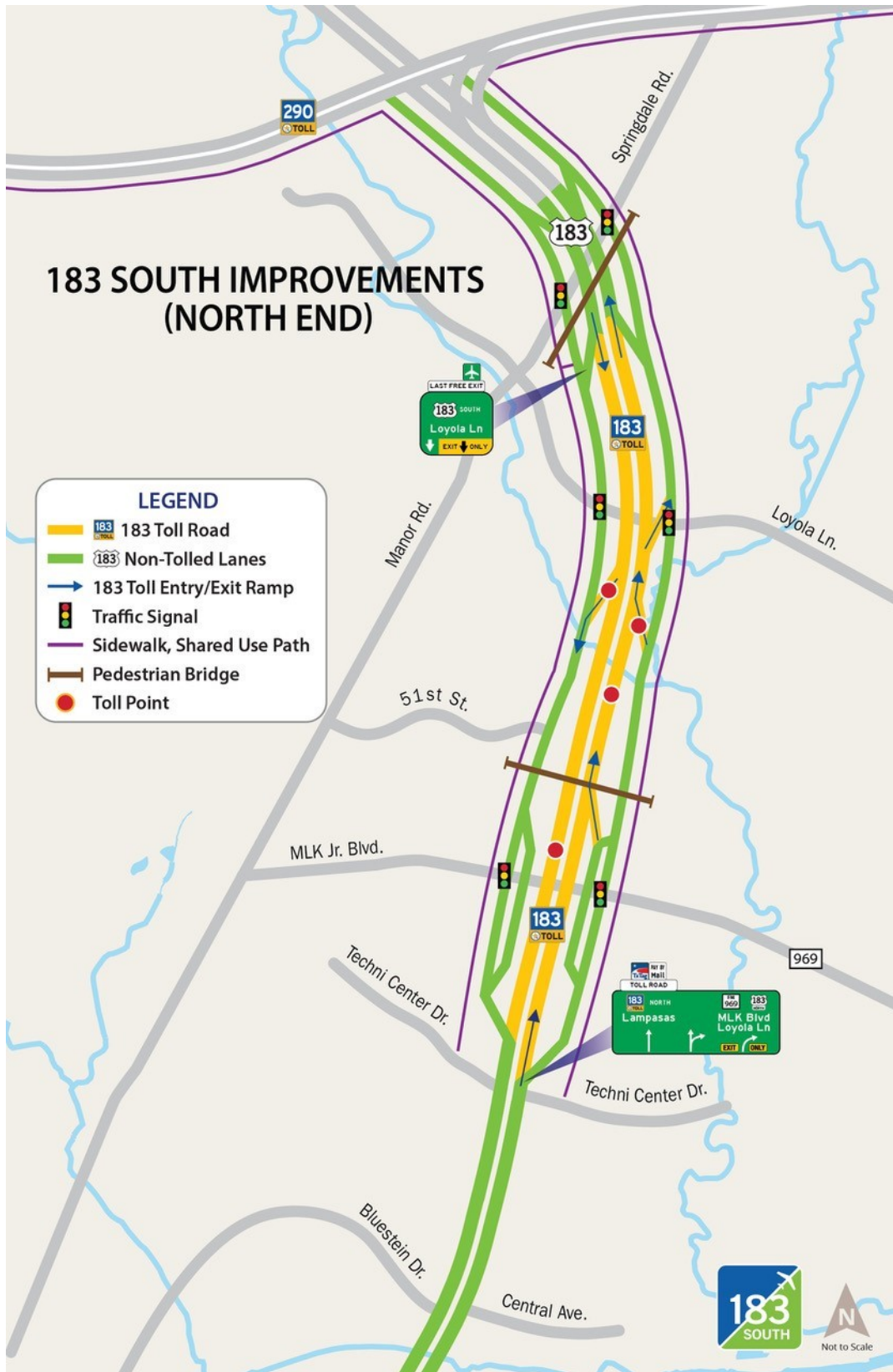


Figure 2-11: 183 South Toll Road (North End) Project Configuration

2.1.1.7 *Traffic Incident and Management Center (TIM Center)*

The TIM Center is located at 104 North Lynnwood Trail in Cedar Park, Texas, and is staffed from 5:30 am to 8 pm during weekdays. The TIM Center has overall responsibility for toll operations and can override pricing and/or open managed lanes to general traffic in accordance with CTRMA. The TIM Center’s operational responsibilities include the following:

1. Facilitate smooth traffic flow
2. Actively monitor real-time traffic and incidents during peak hours
3. Ensure trip building transactions are correct according to the current business rules
4. Provide monitoring and maintenance for roadside equipment

2.1.2 Future Facilities

This section provides information about future CTRMA facilities.

2.1.2.1 *183A Phase III*

CTRMA is proposing to extend 183A north from Hero Way to 1.1 miles north of SH 29 as Phase III of the 183A system (Figure 2-12). The 6.6-mile proposed roadway will have two tolled lanes in each direction with an option to widen to three lanes in the future. The location of the proposed roadway shall be mostly within the median of the US 183 corridor. Schematic design, traffic modeling, and environmental investigations are underway. The extension will also feature a shared-use path north from Hero Way to the proposed Seward Junction Loop project. The project received environmental clearance in August 2019 and is currently undergoing final design. Construction is planned to begin in early 2021.



Figure 2-12: 183A Phase III Study Area

2.1.2.2 183 North

The 183 North Mobility Project (Figure 2-13) includes the construction of two variably priced express lanes in each direction along a 9-mile stretch of US 183 between SH 45/RM 620 and MoPac. This project also includes an additional lane (or lanes as necessary) to bring the number of non-tolled lanes to four in each direction. Express lane direct connectors shall be constructed with MoPac to the south. Construction on this project is scheduled to begin in early 2021.



Figure 2-13: 183 North Project Map

2.1.2.3 MoPac South

The MoPac Expressway south of Cesar Chavez Street is a vital artery in Austin for commuters, neighbors, and visitors (Figure 2-14). This corridor provides a critical link to downtown Austin and other major highways such as US 290 and Loop 360. CTRMA and its partners launched an environmental study in 2013 to analyze the corridor and determine the best approach to managing congestion. The study identified a full range of alternatives, including Express Lane(s), High Occupancy Vehicles Lanes (HOV), Transit Only Lanes, additional General-Purpose Lanes, and Transportation Demand Management Alternatives. The thorough evaluation determined that the Express Lane(s) option was the recommended build alternative because it best met the purpose and need of the study.

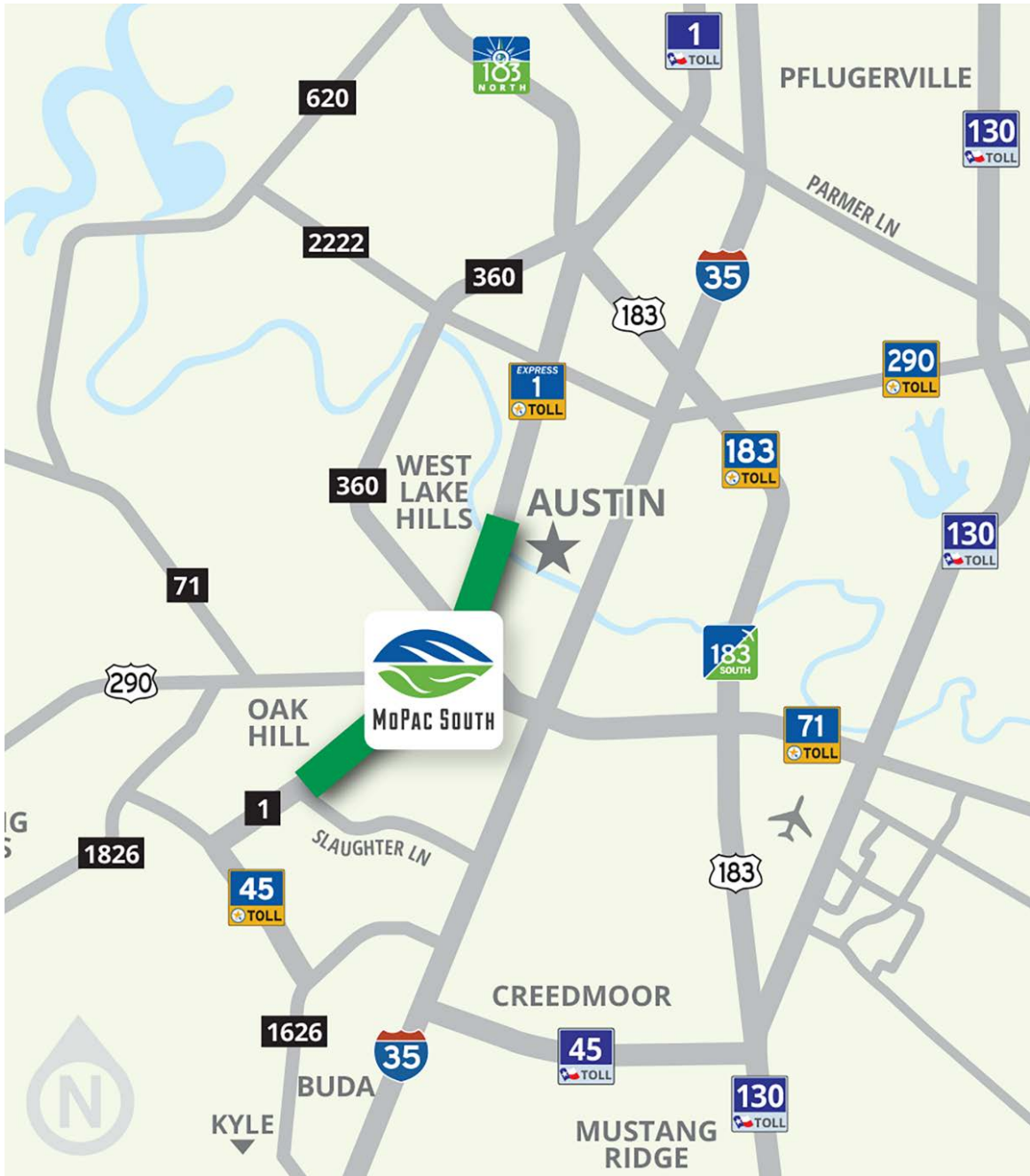


Figure 2-14: MoPac South Project Map

2.1.2.4 290 Toll Phase III

CTRMA, in coordination with TxDOT, has developed plans to construct three direct connectors at the SH 130 interchange (Figure 2-15). These bridges will give drivers a free-flowing direct connection and free up capacity on the frontage road intersection underneath the toll facilities. Construction of three direct connector flyover ramps to link 290 Toll with SH 130 began in late 2018 and is expected to be complete in late 2021, providing a long-term mobility solution for commuters at this intersection.



Figure 2-15: 290 Toll Phase III Project Map

2.2 GENERAL PROJECT INFORMATION

This contract is to provide an ETCS that includes roadside functionality (AVI, AVC, VES, DVAS) and Toll Facility Host (TFH) functionality. The TFH functionality includes trip building, dynamic pricing, image processing, reporting/auditing, and interfaces with other CTRMA third-party systems. The Toll Systems Integrator (TSI) shall be responsible for all aspects of system design, testing, installation/implementation, integration, training, and maintenance of CTRMA's AET and Express Lanes (EL). The ETCS will integrate with CTRMA's Data Platform System (DPS), which connects to CTRMA's Pay By Mail system and the Central US Interoperability (CUSIOP) Hub for away agency processing.

The TSI shall provide an ETCS that includes the following, at a minimum:

1. Roadside systems and infrastructure to support AVI, AVC, VES (cameras), DVAS (cameras), and all related/required components and sensors. Refer to Section 2.2.1, Work Authorization and Project Delivery for more information.
2. Variable Toll Message Signs (VTMS) to display toll rates on Express Lane (EL) facilities.
3. Appropriate applications to support daily operations of CTRMA's facilities.
4. Processing, tracking, and storing all transactions generated by roadside tolling equipment.
5. A trip building system that creates trips based on CTRMA's business rules.
6. Complete image processing to provide license plate information of images captures on the roadside, including all systems, and required operations staff.
7. A dynamic pricing system that calculates and provides toll rates based on traffic conditions in the Express Lanes and General Purpose (GP) lanes.
8. Communication of toll rates to the Variable Toll Message Signs (VTMS) located on Express Lanes.
9. An interface with CTRMA's DPS for transmission and reconciliation of trips, images, and for receipt of Transponder Validation Lists (TVL) and other files.
10. A comprehensive reporting system.
11. All necessary maintenance services to support all hardware, software, and network on the ETCS.
12. A Maintenance Online Management System (MOMS) that supports configurable alerts/alarms, work order creation, and dashboards.
13. Employ, train, supervise, and schedule the required staff to support CTRMA's TIM Center operation, including actively monitoring traffic flow and incidents, reviewing trip building processes to ensure accuracy, and provide monitoring of express lane roadside equipment.
14. User manuals and training for TSI-provided systems and software.
15. Network administration of all ETCS communications equipment, software, cables, connections, configurations necessary to operate the ETCS.

More detailed requirements for these systems and subsystems are described in Sections 2.4, 2.5, 2.6, and 2.15.

2.2.1 Work Authorization and Project Delivery

Each installation of a new facility or transition of an existing facility will be based on individual Work Authorizations approved by CTRMA. Refer to Sections 2.7, Project Management, 2.8, Installation of New Facilities, and 2.9, Transition of Existing Facilities, for further information.

Each Work Authorization will include, at a minimum, the following:

1. General description of the toll road infrastructure and site
2. General requirements of the ETCS
3. Scope of Work (SOW)
4. ETCS equipment and installation requirements
5. Civil/roadway construction requirements (i.e., work by others)
6. The ETCS project implementation or transition schedule
7. Construction schedule (if required)
8. Coordination and project management requirements
9. Toll facilities responsibility matrix
10. Milestone payment schedule
11. Detailed drawings, diagrams, and other required engineering documents (provided by CTRMA)
12. Price sheet
13. Project-level documentation

Additional project documentation will include the following, as defined in Section 2.7.3.1.2, Project-Level Documentation, and Section 2.11, Project Documentation.

Given the segmentation of work based on individual Work Authorizations, the TSI may only be required to update or amend existing documentation to reflect changes to hardware, software, processes, or requirements to reflect designs and project plans for new or transitioned facilities. CTRMA intends to reduce the amount of unnecessary and repetitious documentation as much as possible.

The Milestone Payment Schedule is based on each Work Authorization. The following examples represent the Milestone Payment Schedule for each phase of work, as described in Transition Phases, Section 9.6

Table 2-1: Milestone Payment Schedule for Phase I Work

Milestone Payment Schedule for Phase I - Includes TFH implementation, first facility transition, and delivery of all program documents			
ID	Payment Milestone	% Paid	Cumulative % Paid
A. Mobilization Applies to Section A Mobilization of Cost Proposal Form			
A-1	Mobilization		

Milestone Payment Schedule for Phase I - Includes TFH implementation, first facility transition, and delivery of all program documents			
ID	Payment Milestone	% Paid	Cumulative % Paid
	- Mobilization (upon Work Authorization approval)	100%	100%
B. Hardware and Equipment Ordering and Installation Applies to Section B System Procurement and Installation of Cost Proposal Form			
Equipment Ordering, Installation, and Testing			
B-1	-Purchased, Received and Verified	10%	10%
	-Start of installation activities	15%	25%
	-Installation activities complete	15%	40%
	-Site Installation Test completed and approved	20%	60%
	-Integration Test completed and approved	20%	80%
	-Operational Acceptance Test completed and approved	20%	100%
C. Project Management, Documentation and Testing Services Applies to Section C Project Management and Testing Services of Cost Proposal Form			
Project Management Documentation Approval			
C-1	- Master Project Schedule	5.0%	5.0%
	- Program Management Plan <i>includes the following</i>		
	- a. Roles and Responsibilities		
	- b. Scope Management Plan		
	- c. Quality Management Plan		
	- d. Communication Management Plan		
	- e. Requirement Management Plan		
	- f. Change Management Plan		
	- g. Configuration Management Plan		
- h. Risk Management Plan			
Design Documentation Approval			
C-2	- Software Development Plan	10.0%	15.0%
	- Requirements Traceability Matrix		
	- Master Test Plan		
	- Interface Control Documents		
	- System Detailed Design Documents		

Milestone Payment Schedule for Phase I - Includes TFH implementation, first facility transition, and delivery of all program documents			
ID	Payment Milestone	% Paid	Cumulative % Paid
	- Reports Detailed Design Documents		
	- Data Migration Plan (REMOVED FROM SCOPE OF WORK)		
	- Disaster Recovery Plan		
	- Backup Recovery and Archive Plan		
C-3	Test and Go-Live Planning Documentation		
	- TFH and Roadside Test Plans and Procedures	10.0%	25.0%
	- Installation Plan (for TFH and facility)		
	- Transition Plan (for TFH and facility)		
C-4	Test Results and As-Built Documentation		
	- Test Reports	10%	35.0%
	- As-Built Drawings for transitioned facility		
C-5	Training and maintenance documentation and manuals Approval		
	- Training Plan and Materials	5%	40.0%
	- Roadside System Flow Diagram		
	- MOMs User Manual		
	- Reporting Manual		
	- DVAS Manual		
	- Audit and Reconciliation Manual		
	- Dynamic Pricing and Trips Manual		
	- Maintenance Plan		
	- Initial Inventory (including spares)		
	- Safety plan		
	- Traffic Control Plan		
	- Security Plan		
- Succession Plan			
C-6	TFH FAT completed and approved	10%	50.0%
C-7	TFH Integration to CTRMA DPH	5%	55.0%
C-8	TFH SIT completed and approved	10%	65.0%
C-9	Roadside Facility FAT completed and approved	5%	70.0%
C-10	All toll sites commissioned	10%	80.0%

Milestone Payment Schedule for Phase I - Includes TFH implementation, first facility transition, and delivery of all program documents			
ID	Payment Milestone	% Paid	Cumulative % Paid
C-11	Training Completed and Go-Live	10%	90.0%
C-12	OAT for TFH and Facility completed and approved, and Final As-Built drawings representative of any changes made during test and acceptance.	10%	100.0%

Table 2-2: Milestone Payment Schedule for Phase II Work

Milestone Payment Schedule for Phase II - Includes each transitioned or new facility, project documentation, and program documentation updates			
ID	Payment Milestone	% Paid	Cumulative % Paid
A. Mobilization Applies to Section A Mobilization of Cost Proposal Form			
A-1	Mobilization		
	- Mobilization (upon Work Authorization approval)	100%	100%
B. Hardware and Equipment Ordering and Installation Applies to Section B System Procurement and Installation of Cost Proposal Form			
B-1	Equipment Ordering, Installation, and Testing		
	- Purchased, Received and Verified	10%	10%
	- Start of installation activities	15%	25%
	- Installation activities complete	15%	40%
	- Site Installation Test completed and approved	20%	60%
	- Integration Test completed and approved	20%	80%
	- Operational Acceptance Test completed and approved	20%	100%
C. Project Management, Documentation and Testing Services Applies to Section C Project Management and Testing Services of Cost Proposal Form			
C-1	Project Management Documentation Approval		
	-Work Authorization (Project) Schedule	2.5%	2.5%
	- Project Risk Register		
	- Responsibility Matrix		
	- Updated Roles and Responsibilities		
- Communication Plan			
C-2	Design Documentation Update Approval		
	- Updated Requirements Traceability Matrix	5.0%	7.5%
	- Updated Master Test Plan		
	- Updated Interface Control Documents		
	- Updated System Detailed Design Documents		
	- Updated Reports Detailed Design Documents		
	- Updated Data Migration Plan (REMOVED FROM SCOPE OF WORK)		
- Updated Disaster Recovery Plan			

Milestone Payment Schedule for Phase II			
- Includes each transitioned or new facility, project documentation, and program documentation updates			
ID	Payment Milestone	% Paid	Cumulative % Paid
	- Updated Roadside System Flow Diagram		
	- Updated Backup Recovery and Archive Plan		
Test and Go-Live Planning Documentation Approval			
C-3	- Test Plans and Procedures	5.0%	12.5%
	- Installation Plan (for each new facility)		
	- Transition Plan (for each transitioned facility)		
Test Results and As-Built Documentation			
C-4	Test Reports	5.0%	17.5%
	As-Built Drawings for each transitioned / new facility		
Training, Maintenance documentation and Manual Update Approval			
C-5	- Updated Training Plan and Materials	2.5%	20%
	- Updated Roadside System Flow Diagram		
	- Updated Manuals (to all applicable systems)		
	- Updated Maintenance Plan		
	- Updated Inventory (including spares)		
	- Updated Succession Plan		
C-6	Factory Acceptance Test completed and approved	15%	35%
C-7	Configuration of Toll Facility Host	10%	45%
C-8	Site Installation Test completed and approved	10%	55%
C-9	All toll sites commissioned	15%	70%
C-10	Training Completed / Go-Live (start of revenue collection)	15%	85%
C-11	Operational Acceptance Test completed and approved, and Final As-Built drawings representative of any changes made during test and acceptance.	15%	100%

Table 2-3: Milestone Payment Schedule for Phase III Work

Milestone Payment Schedule for Phase III		
ID	Payment Milestone	Cumulative % Paid
C. Final Documentation		
Applies to Section C Project Management and Testing Services of Cost Proposal Form		
C-60	Test Reports (Test Reports have been approved)	100%
	As-Built Drawings representative of any changes made during test and acceptance (As-Built Drawings from each Work Authorization have been approved)	
	Transition Plan (Verify the Program Transition Plan has been approved and updated as part of each Work Authorization)	
	Program Documentation updates (Verify the Program Documentation has been updated as part of each Work Authorization)	
	Network Diagram updates (Verify network diagrams have been updated with the as-is for those portions of the network that are within the TSI scope of each work authorization.)	
	Inventory (including spares) (Verify the inventory has been provided to CTRMA.)	

2.3 EXISTING EQUIPMENT, INFRASTRUCTURE, BUILDINGS, AND COMMUNICATION

The TSI has the option to reuse certain roadside tolling equipment/devices, along with all existing infrastructure, conduits, cabinets, hub buildings, and electrical and communications equipment and cabling. This section describes the equipment and infrastructure that is currently installed. Unless explicitly stated otherwise, the TSI may reuse any or all equipment currently installed, subject to the limitations of the approved transition plan.

The TSI has the option of retaining the existing equipment specified herein, with the condition the TSI’s delivered system will conform to contractual functional and performance requirements for the term of the contract. CTRMA does not assert the condition, functionality, or performance of installed equipment. It is incumbent on the TSI to determine the condition and fitness for the use of any currently installed equipment to be reused.

All other equipment provided under this Scope of Work will also be required to meet the requirements detailed herein and applicable Service Level Agreements (SLA), as described in Appendix 7, Service Level Agreement (SLA).



Additionally, the TSI shall de-install, remove from the premises, and properly dispose of any un-needed existing equipment following the appropriate CTRMA policies.

Table 2-4: General Requirements

ID	Rule
REQ-1	If any proposed new equipment increases non-dynamic/static forces or dynamic/live load on an existing support structure, the TSI shall submit a structural analysis of the existing support structure for CTRMA’s review, approval, and professional stamp.

2.3.1 Existing Tolling Equipment

As previously described in Section 2.1, CTRMA operates five (5) All-Electronic Toll (AET) facilities, including one (1) Express Lane facility in the Austin area. Table 2-5, sorted by monthly average transaction data per facility, provides a listing of the different CTRMA facilities and plazas and their historical transaction data.

Table 2-5: The Historical Transaction Data of CTRMA Facilities and Plazas

Facility	Plaza	Type	Monthly Average Transaction Data (2019)	Generator at Plaza
183-A	Park Street Mainline NB	Mainline	1,056,625	Yes
183-A	Park Street Mainline SB	Mainline	1,001,870	No
183-A	Lakeline NB Mainline	Mainline	780,687	Yes
183-A	Lakeline SB Mainline	Mainline	689,193	Yes
183-A	Crystal Mainline SB	Mainline	605,071	No
183-A	Crystal Mainline NB	Mainline	588,867	Yes
183-A	Brushy Creek NB	Ramp	147,436	Yes
183-A	Brushy Creek SB	Ramp	106,135	Yes

Facility	Plaza	Type	Monthly Average Transaction Data (2019)	Generator at Plaza
183-A	Scottsdale Drive NB	Ramp	38,636	Yes
183-A	Crystal Parkway NB	Ramp	15,587	No
183-A	Crystal Parkway SB	Ramp	14,667	No
183-S	MLK Mainline SB	Mainline	146,961	No
183-S	51st Mainline NB	Mainline	36,710	Yes
183-S	51st Exit Ramp	Ramp	59,039	Yes
183-S	51st Entry Ramp	Ramp	169,522	Yes
US290 E	Giles Mainline WB	Mainline	538,766	Yes
US290 E	Giles Mainline EB	Mainline	508,628	No
US290 E	Parmer Mainline EB	Mainline	356,354	Yes
US290 E	Parmer Mainline WB	Mainline	331,139	No
US290 E	183 Entry	Ramp	289,436	Yes
US290 E	183 Exit	Ramp	218,423	No
US290 E	Giles Lane WB	Ramp	71,792	Yes
US290 E	Giles Lane EB	Ramp	62,945	No
US290 E	Springdale Road EB	Ramp	26,872	No
US290 E	Harris Branch EB	Ramp	21,938	No
US290 E	Harris Branch WB	Ramp	15,286	Yes
US290 E	Springdale Road WB	Ramp	14,649	Yes
US290 E	130 DC Entry WB	Ramp	6,745	Yes
SH-71	973 East	Mainline	475,368	Yes
SH-71	973 West	Mainline	395,249	No
MoPac	RM2222 SB	Mainline	377,282	Yes
MoPac	Enfield NB	Mainline	335,772	Yes
MoPac	Far West NB	Mainline	204,104	Yes
MoPac	Parmer SB	Mainline	158,302	Yes
45 SW	Bear Creek Mainline WB	Mainline	100,114	No
45 SW	Bear Creed Mainline EB	Mainline	91,495	Yes

There are also three locations on MoPac that support portable generators. These locations are not tolling sites (plazas); they are sign cabinets.

Detail of the hardware currently installed at these plazas can be found in Appendix 16, Existing Conditions Report. Details of the available spare hardware can be found in Appendix 9, Equipment List.

2.3.2 Existing Deficiencies

After the TSI assesses the existing equipment and infrastructure, the TSI shall be required to certify in writing to CTRMA that the ETCS, with the incorporation of any reused equipment, and the CTRMA-owned infrastructure, will meet the project SLAs as described in Appendix 7, Service Level Agreement. This certification shall be delivered to CTRMA no later than ninety (90) days after the issuance of a Work Authorization providing for the assessment of existing equipment and will communicate all existing equipment defects affecting functionality or performance

found. Defects identified after the ninety (90) day period shall be solely on the TSI to resolve. CTRMA will inspect each claimed defect within thirty (30) business days and determine the appropriate action (e.g., repair, replace, or retain as is) and the timing of the action. Any agreed-upon repair or replacement work may be performed through a change order.

2.4 ZONE CONTROLLER SUBSYSTEM

The functionality of the zone controller includes the following, at a minimum:

Table 2-6: Zone Controller Subsystem Technical Requirements

ID	RULE
REQ-2	The zone controllers shall be required to meet all applicable SLAs, as described in Appendix 7, Service Level Agreement.
REQ-3	The zone controllers are required to be implemented in a redundant, highly available configuration/capacity in either a highly-available or passive-active architecture.
REQ-4	The zone controller’s failover system shall ensure there is no loss of transactions or revenue due to a single zone controller failing. Any downtime between when a primary zone controller stops processing transactions, and the secondary zone controller begins processing transactions will count against the AV1 Zone Controller Availability.
REQ-5	The failover of a single zone controller shall not disrupt the operation of any other subsystem(s) and shall not require a restart of any subsystem.
REQ-6	Alarm messages shall be generated and transmitted to MOMS whenever a zone controller failover or outage event occurs.
REQ-7	The ETCS shall provide authorized users the capability to switch manually and remotely from the primary zone controller to the secondary zone controller. The switching from the primary zone controller to a secondary zone controller shall be recorded and transmitted to MOMS.
REQ-8	All zone controllers shall be capable of processing transaction volumes of at least 3,000 vehicles per lane per hour.

2.4.1 Stand-Alone Operation

Table 2-7: Stand-Alone Operation Technical Requirements

ID	RULE
REQ-9	The zone controllers shall be capable of operating in a stand-alone mode during communications disruptions between the zone controller and the TFH.
REQ-10	While in stand-alone mode, the zone controllers shall be capable of storing all transaction records, events, and maintenance messages for a minimum of thirty (30) days.
REQ-11	Complete lane transactions buffered in the lane when communications are lost shall be forwarded to the TFH when communications are restored.
REQ-12	When operating in stand-alone mode, the last configuration, security access, and application files downloaded from the TFH shall be used until communication is restored or files are uploaded locally.
REQ-13	Upon restoring communication with the TFH, all backlogged messages shall be transmitted without affecting near real-time transmission of ongoing transactions.

2.4.2 Software

Table 2-8: Software Technical Requirements

ID	RULE
REQ-14	Zone controllers shall process data obtained from AVI, AVD, AVC, VES, and other roadside devices and equipment systems to generate transaction records for each passing vehicle.
REQ-15	The operating systems, databases, COTS software, and ETCS software provided by the TSI shall support near real-time transaction creation.
REQ-16	The proposed operating systems and databases shall be currently supported versions/releases (i.e., no beta releases) with a future upgrade path. The zone controller’s operation system shall be the same version across all facilities.
REQ-17	The zone controller application version will be the same across all facilities.
REQ-18	Zone controller software shall be parameter-driven and user-configurable and shall be warranted against software defects and deficiencies until the contract is terminated.
REQ-19	All messages between the zone controller and the VES (e.g., ALPR data, triggers, and transaction link data), AVI, AVD, and AVC subsystems, and the TFH shall use a documented, non-proprietary protocol. This protocol shall be made available to and approved by CTRMA during the design phase of the project.
REQ-20	Zone controllers shall be required to detect and frame vehicles, including those with valid transponders, and associate all transactions with correct vehicle VES images.
REQ-21	One and only one transaction record shall be created for each vehicle that travels through a Toll Zone, and zone controllers shall ensure all available input data has been written to the transaction record before transmitting it to the TFH.
REQ-22	The zone controllers shall be able to automatically synchronize with the various sensors and subsystems at the lane level to ensure the events in the lane are associated with the correct vehicle transaction record.
REQ-23	Along with all other data elements required for a transaction record, vehicle length shall also be included.

2.4.3 Time Synchronization

Table 2-9: Time Synchronization Technical Requirements

ID	RULE
REQ-24	Zone controllers shall be time-synchronized to the Time Server at the time of zone controller startup and periodically after that.
REQ-25	The zone controller shall synchronize or transmit time synchronization messages with every connected Toll Zone subsystem or device/equipment capable of maintaining time.

2.4.4 Monitor All Lane Equipment for Device Status

Table 2-10: Monitor All Lane Equipment for Device Status Technical Requirements

ID	Rule
REQ-26	Each zone controller shall self-monitor the system health of internal components and all associated in-lane equipment device for status.
REQ-27	The system shall generate a recovery message and restore its operational status if a device recovers after reporting a failure.
REQ-28	Recovery messages shall be: <ol style="list-style-type: none"> 1. Recorded against the original failure work order 2. Reported through MOMS 3. Available to authorized staff
REQ-29	All alarm, health, and recovery messages shall be transmitted and reported to MOMS.
REQ-30	Anytime a work order is closed, the system shall automatically enable any/all alarms for the repaired equipment.

2.4.5 Diagnostics and Equipment Malfunction

The TSI shall ensure the system continues to operate without loss of revenue or visible impact to the patron if some components of the system fail, and the system begins degraded mode operations.

Table 2-11: Diagnostics and Equipment Malfunction Technical Requirements

ID	RULE
REQ-31	The zone controller software shall execute periodic diagnostics checks on all internal processes, the in-lane equipment, and interfaces. A device’s failure to respond to a status inquiry after a user-configurable number of retries shall be regarded by the zone controller software as an equipment failure.
REQ-32	All failures detected and alarms generated shall be reported to MOMS. Degraded modes of operation shall be supported based on CTRMA’s business rules developed during the design process and approved by CTRMA.

2.4.6 Configuration Files

Table 2-12: Configuration Files Technical Requirements

ID	RULE
REQ-33	All parameters and settings required to operate the zone controller application shall be maintained in a configuration file or files.
REQ-34	A copy of the current zone controller configuration files shall be maintained on the TFH and shall be available for downloading along with the zone controller application file, as needed.
REQ-35	Authorized personnel working in the field shall be able to make changes to the configuration file used by the zone controller.
REQ-36	Changes made in the field shall be backed up to the TFH. Any configuration files changed in the field shall be logged and assessed for applicability to all zone controllers and downloaded to other zone controllers, accordingly.
REQ-37	All zone controllers shall have default configuration files that allow the lane to startup automatically.

ID	RULE
REQ-38	All zone controllers shall operate with the same software version unless CTRMA approves exceptions to this requirement.

2.5 ROADSIDE SUBSYSTEM

The following sections provide requirements about the roadside subsystem.

2.5.1 Automatic Vehicle Identification (AVI) Subsystem

The TSI shall determine the need for conducting radio frequency (RF) interference tests at all proposed project sites that are currently equipped with Radio Frequency Identification (RFID) products. The TSI shall assure all related licensing and requirements are satisfied and to be aware of any RF sources that may interfere with the ETCS. CTRMA currently operates its AVI readers between 902.5 MHz and 921.5 MHz.

The TSI has responsibility for compiling all Federal Communication Commission (FCC) licensing materials.

The TSI shall provide certification that any new proposed reader’s 6C capabilities have been certified by an approved independent third-party laboratory (e.g., certification under the OmniAir Certification Services’ ISO 18000-6C certification program will satisfy this requirement).

The TSI shall be responsible for the AVI subsystem, including any design, provision, and installation involving enclosures (including heating/cooling if required), cabling, brackets, and ancillary components required for the proper functioning/operation of this subsystem. The TSI shall ensure the AVI subsystem meets the performance requirements identified in Appendix 7, Service Level Agreement.

After initial installation, the TSI maintains responsibility for the completion and submission of any FCC-required applications and maintenance forms to CTRMA for submission to the FCC.

CTRMA is responsible for submitting the completed forms to the FCC and the payment of all related FCC licensing costs.

CTRMA does not write to any transponders via the roadside ETCS.

Table 2-13: AVI Subsystem Technical Requirements

ID	RULE
REQ-39	The AVI subsystem shall support all applicable AVI business requirements and performance levels, as defined in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement.
REQ-40	The AVI subsystem shall include a multi-protocol RFID reader capable of reading three standard protocols (E-ZPass TDM, ISO 18000-6C, and SeGo) at performance levels defined in Appendix 7, Service Level Agreement.
REQ-41	The AVI subsystem shall read all approved transponder types in vehicles (when present and properly mounted) that pass through the toll zone, including vehicles within travel lanes, straddling lanes, without degradation or interference at speeds ranging from stop-and-go to 100 mph.

ID	RULE
REQ-42	The AVI subsystem shall account for every lane transaction that is the result of a buffered/spurious transponder read for tracking and disposition, which shall be reported on and auditable by CTRMA.
REQ-43	The lane transaction shall indicate subsystem shall record up to three transponders and include them in the transaction record.
REQ-44	The lane transaction shall indicate which transponder is assumed to be the valid transponder for processing by the TFH. The lane transaction shall also include the other transponders in the lane transaction message.
REQ-45	Each RFID reader stores all information related to at least 125,000 transponder reads if the RFID operates in a stand-alone mode (i.e., there is no zone controller connectivity).

2.5.2 Automatic Vehicle Detection (AVD) and Classification (AVC) Subsystem

The TSI shall provide for both in-ground and above ground Automatic Vehicle Detection (AVD) and Automatic Vehicle Classification (AVC) systems. Wherever the TSI chooses to re-use existing in-ground AVD and AVC systems on existing CTRMA facilities, the TSI shall certify in writing to CTRMA that the ETCS, with the incorporation of any reused equipment, and the CTRMA-owned infrastructure, will meet the project SLAs as described in Appendix 7, Service Level Agreement.

CTRMA will direct the TSI to implement either in-ground or above ground AVD and AVC systems, on a per facility basis, and even on a per location basis. The TSI is encouraged to provide designs that will contribute to an infrastructure that takes into consideration all aspects of long-term maintenance and support. It is, however, incumbent on the TSI to provide a technically compliant, competitively priced solution that meets the stated requirements.

Both in-ground and above ground ACD and AVC systems will meet the following technical requirements:

Table 2-14: AVC Subsystem Technical Requirements

ID	RULE
REQ-46	The AVC subsystem shall support all applicable AVC business rules and performance requirements, as described in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement.
REQ-47	The AVC subsystem shall detect all vehicles that pass-through toll lanes and toll zones, including vehicles within travel lanes, within shoulders, straddling lanes, or straddling a lane and shoulder, without degradation or interference.
REQ-48	The AVC subsystem shall correctly separate vehicles moving below 30 miles per hour within 2 feet distance measured front to rear, and within 5 feet distance measured front to rear above 30 miles per hour, to ensure that multiple vehicles are not identified as a single vehicle.
REQ-49	The AVC subsystem shall correctly associate multi-unit vehicles (e.g., a vehicle towing a trailer) using a minimum 2-inch tow bar (measured perpendicular to the lane direction of travel) to ensure that the multi-unit vehicle is identified as a single vehicle.
REQ-50	If the TSI proposes an overhead AVC subsystem, the system must be able to be implemented as a redundant trigger to the VES cameras.

ID	RULE
REQ-51	The Vehicle Detection, Separation, and Classification subsystem shall support all applicable vehicle detection and separation business rules and performance requirements as defined in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement, including the following: <ol style="list-style-type: none"> 1. Detecting vehicles at required speeds 2. Separating vehicles at required speeds Classifying vehicles at required speeds
REQ-52	The Vehicle Detection, Separation, and Classification subsystem shall provide vehicle event messages and signals to the zone controller and may also directly trigger the VES cameras.
REQ-53	The status of the Vehicle Detection, Separation, and Classification subsystem shall be reported to MOMS, and the zone controller shall write health status codes to transaction records indicating a degraded state when the transaction is built.

2.5.3 Violation Enforcement Subsystem (VES)

Table 2-15: Violation Enforcement Subsystem Technical Requirements

ID	RULE
REQ-54	The VES shall support all applicable VES business and performance requirements, as defined in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement.
REQ-55	All transactions (including those with transponders) shall have images captured and associated.
REQ-56	The VES shall capture images of all vehicle license plates with sufficient sharpness for the ALPR to automatically extract the plate number, type, and jurisdiction.
REQ-57	The VES shall capture at least one front and one rear image of every vehicle that passes through a lane or Toll Zone. All images captured shall be associated with the correct lane transaction.
REQ-58	The VES shall create a region of interest image from the image used to determine the license plate data showing a focused view of the license plate with the license plate data readable to the unaided eye.
REQ-59	The VES shall machine-read images and identify license plate information, including license plate type, alphanumeric characters, and jurisdiction of origin, to be included in the lane transaction message. The lane transaction message shall also include automated ALPR processing confidence levels.

ID	RULE
REQ-60	The VES shall flag all images which should be queued for human review, by user-configurable parameters, including the following: <ol style="list-style-type: none"> 1. ALPR confidence threshold 2. License plates/vehicles that have not been previously recorded by the system 3. Random images with configurable sample sizes 4. Other unusual occurrences such as vehicle classification mismatches 5. Any other parameter required for the TSI’s Quality Assurance/Quality Control (QA/QC) process for images to achieve the performance requirements
REQ-61	The VES shall buffer/store images locally (either in the Toll Zone or a Host system) until successful image transmission to the storage location for image review.
REQ-62	The VES shall store all images (including those associated with valid AVI transactions) for a user-configurable rolling period per CTRMA’s data retention guidelines. Refer to Appendix 12, Data Retention Schedule.
REQ-63	The VES shall make images available to CTRMA’s Host per the accepted Interface Control Document (ICD).
REQ-64	Images shall be stored image-by-image as separate digital files, with an open-standard file architecture linked to the transaction record.
REQ-65	To support the rapid detection of poor performing cameras, the VES shall send alarm messages to MOMS. These messages shall indicate if the image quality of a VES camera has degraded such that its ALPR confidence falls below a user-configurable threshold. This threshold shall be based on the rolling average of a user-configurable number of images, or a camera is producing black (i.e., no picture) images.
REQ-66	CTRMA uses a third-party ALPR application for habitual violators and other programs off-line from the TSI-provided ETCS. The TSI shall support this third-party ALPR application by allowing VES images to be accessed in a read-only form. This access will be available to the third-party application in near real-time of the image capture at the roadside.

2.5.3.1 VES Cameras and Illumination Devices

The TSI shall be responsible for familiarizing themselves with all roadside illumination specifications.

Table 2-16: VES Cameras and Illumination Devices Technical Requirements

ID	RULE
REQ-67	Camera illumination devices shall be mounted/installed in such a way as not to distract or limit the vision of drivers. Visible light levels shall not be increased at any Toll Zones.
REQ-68	Cameras and illumination devices shall support a capture rate of no fewer than two vehicles per second.

2.5.4 Uninterruptible Power Supply (UPS) Subsystem

Table 2-17: UPS Subsystem Technical Requirements

ID	RULE
REQ-69	All toll equipment shall be UPS protected and supported with a minimum of one (1) hour runtime. Whenever a UPS is activated, an alert shall be sent to MOMS. The TSI shall monitor all UPS alerts, which may include the Simple Network Monitoring Protocol (SNMP) using a COTS smart interface module
REQ-70	Should the TSI chose not to reuse the existing UPS subsystem, the TSI shall furnish a UPS to be mounted in cabinets that include an exterior locking receptacle for plugging in a portable generator to allow connectivity with no tools required.
REQ-71	If an online UPS fails, an auto-sync transfer shall bridge line power and utility power so that power supply is maintained.
REQ-72	A surge protection device shall be used to protect utility service that is not UPS filtered.
REQ-73	UPS installation shall include a bypass switch to allow maintenance of the UPS module while continuing to service the current electrical load.
REQ-74	Whenever any of the following occur, an alert/alarm shall be generated and sent to maintenance personnel and the CTRMA staff via MOMS: <ol style="list-style-type: none"> 1. UPS detects loss of electrical utility service 2. UPS battery level reaches a user-configurable low point 3. UPS is bypassed or disconnected

2.5.5 Digital Video Audit Systems (DVAS)

The TSI shall either furnish and install new or certify and accept in conjunction with CTRMA’s existing DVAS equipment.

The TSI shall provide a comprehensive DVAS that enables the CTRMA staff to verify/reconcile/audit toll transactions from all lanes, to review videos of events and/or incidents in the express lane(s), and to identify possible irregularities.

Table 2-18: Digital Video Audit Systems (DVAS) Technical Requirements

ID	RULE
REQ-75	The DVAS shall interface with other roadside equipment to receive vehicle transactional and status data of toll lane equipment. This data shall include individual sensor state changes, AVI reads, location (e.g., facility, plaza, lane), date/time, vehicle class, and toll rate.
REQ-76	During design and installation, the DVAS cameras will be positioned or repositioned such that they can distinguish all axles having wheels in contact with the pavement and raised axles where the wheels are not in contact with the pavement.
REQ-77	During design and installation, the DVAS cameras can be relocated for axle-verification.
REQ-78	Zone controller transactional data will be overlaid onto the DVAS video data displayed on the screen. This transactional data shall include the following, at a minimum: date, time, lane, plaza, facility, classification, and transponder number.

ID	RULE
REQ-79	The user interface shall provide the capability to select and review videos based on the timeframe, location (e.g., facility, plaza, lane), tag number, vehicle class, and transaction identifier from the TFH. The user interface shall allow the selected video to be replayed in real-time, in slow motion at a maximum playback rate of 1/8x, frame by frame, as well as accelerated playback rate at a minimum of 8x. The user interface will allow the user to “scroll” through the selected video with a pointing device (i.e., mouse).
REQ-80	The DVAS shall have the ability to print selected video images with associated transactional data.
REQ-81	All digitized DVAS video and corresponding transactional data will be synchronized/coupled and will be stored to allow historical viewing and analysis.
REQ-82	The DVAS shall allow an authorized operator/user to set cameras up and configure them individually. Configuration settings shall be available on a per camera basis.
REQ-83	The DVAS shall provide clear video/images of the intended subject area during weather conditions typical to the local Austin area, regardless of ambient lighting.
REQ-84	The DVAS shall provide an overall view of the traffic flow for the toll zone (i.e., loops and treadles).
REQ-85	Whenever DVAS video data is being reviewed, the corresponding transactional data will be displayed on the screen.
REQ-86	As DVAS video is “scrolled,” transactional data elements will “scroll” with the video.
REQ-87	The capability to control any/all DVAS cameras shall be User ID and password protected.
REQ-88	DVAS video shall be stored in an unencrypted format and available for review without the use of special equipment or software in a standard format (e.g., AVI, MP4, MOV).
REQ-89	DVAS video needs to be available for streaming to remote locations (off-site from CTRMA) in real-time, as well as in slow motion at a maximum playback rate of 1/8x, frame by frame, as well as accelerated playback rate at a minimum of 8x
REQ-90	DVAS video shall be stored as defined in CTRMA’s Data Retention Schedule, Appendix 12.
REQ-91	The DVAS shall allow for the export of video to external media in an unencrypted format and available for review without the use of special equipment or software in a standard format (e.g., AVI, MP4, MOV).

2.5.6 Closed Circuit Television (CCTV) Subsystems

CCTV cameras are required along all the CTRMA toll facilities in support of the DVAS and to observe VTMS messages.

The TSI will be responsible for running power/data connections from the power/data equipment enclosure(s) to the TSI installed equipment.

The TSI shall coordinate with CTRMA to establish the initial camera field of view and focus on providing an optimum image both for the DVAS and for the VTMS display.

No existing CCTV cameras used by the CTRMA operations staff for traffic verifications shall be removed from service without notification from CTRMA, and any outage or lapse in roadway coverage shall be limited to overnight or non-peak periods.

Table 2-19: CCTV Subsystem Technical Requirements

ID	RULE
REQ-92	The TSI shall either certify and accept existing CCTV cameras and mounting brackets, cabling and controls or furnish and install replacements meeting all performance, availability, and functionality requirements.
REQ-93	If cameras are proposed to be relocated or expanded, the TSI shall provide installation plans (e.g., shop drawings) for all relocated and expanded CCTV subsystem components.
REQ-94	Shop drawings and as-built drawings for proposed components will be submitted to CTRMA for approval.
REQ-95	All CCTV cameras shall be IP-based digital cameras and connect to the existing fiber communications network supporting all other roadside equipment.
REQ-96	All CCTV camera enclosures shall be designed and manufactured for continuous operation in weather conditions typical to the local Austin area. All CCTV cameras shall provide clear video and images of objects within the field of view regardless of ambient lighting (for both day and night) and weather conditions.
REQ-97	<p>Camera required attributes and capabilities shall include the following:</p> <ol style="list-style-type: none"> 1. Day (color)/night (monochrome) operation 2. IP addressable 3. Digital high definition resolution (1280 x 720 px, minimum) 4. Automatic focus 5. Capable of remote firmware upgrade via the communication interface
REQ-98	<p>Video encoding required attributes and capabilities shall include the following:</p> <ol style="list-style-type: none"> 1. Moving Picture Experts Group’s 4, part 10 (H.264) video compression technology 2. Encoded video transmitted using programmable bit rates 3. Color and monochrome video delivered at up to thirty (30) Frames Per Second (FPS) regardless of resolution
REQ-99	<p>Lens required attributes and capabilities shall include the following:</p> <ol style="list-style-type: none"> 1. Automatic and manual focus and iris control capabilities 2. High definition providing a minimum 24X motorized automatic optical zoom lens with optical iris 3. Depth of field that provides a clear image of roadside areas within the cameras range under all lighting conditions 4. A maximum aperture of at least f/1.6
REQ-100	<p>Dome required attributes and capabilities shall include the following:</p> <ol style="list-style-type: none"> 1. Pressurized dome with low-pressure alarm feature 2. Dome enclosures of NEMA 4X/IP-67 rating
REQ-101	<p>Communication/network interface attributes and capabilities shall include the following:</p> <ol style="list-style-type: none"> 1. National Transportation Communications for ITS Protocol 1205 v1.08 2. Capable of communication with other equipment and processors using transmission control protocol/IP, or user datagram protocol/IP 3. Real-Time Streaming Protocol (RTSP), per IETF RFC 2326 4. IEE802.3 compliant Local Area Network (LAN) connection for 10/100 Ethernet connections 5. Minimum of one 10/100 Base-TX Ethernet port
REQ-102	All components in this subsystem (e.g., cameras and servers) shall be integrated with MOMS for component status reporting, alert generation, and diagnostic messaging.

ID	RULE
REQ-103	All externally mounted or installed components of the DVAS and VTMS CCTV system (e.g., brackets, enclosures, cabling, and connectors) shall be appropriately sealed and/or enclosed such that they will operate continuously. These components shall provide in-focus images for DVAS and VTMS data under typical weather/lighting conditions in the Austin metro region.
REQ-104	The video from these cameras shall be continuously recorded at a minimum of one (1) Frame Per Second (FPS).
REQ-105	
REQ-106	The CCTV equipment shall integrate into a system/application provided by the TSI that the CTRMA staff may utilize to view the VTMS in real-time and review recorded/historical VTMS video data.
REQ-107	CCTV video shall be stored as defined in CTRMA’s Data Retention Schedule, Appendix 12.

2.5.7 Traffic Sensors

Table 2-20: Traffic Sensors Technical Requirements

ID	RULE
REQ-108	The traffic sensor subsystem shall support all applicable traffic sensor business rules and performance requirements as defined in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement.
REQ-109	At a minimum, the proposed traffic sensor units shall measure and output vehicle speed, vehicle count/volume, lane occupancy, and vehicle direction for the same quantity of travel lanes as currently measured.
REQ-110	Proposed traffic sensor units shall support appropriate industry standard requirements for device implementation (IP addressable), device set-up and configuration, operational requirements (all weather conditions), frequency, and will provide for the following, at a minimum: <ol style="list-style-type: none"> 1. Detection of vehicles in up to 12 lanes 2. Detection of vehicles over barriers 3. Detection of vehicles from between 6 ft and 250 ft 4. Per vehicle data including speed, length, class, and lane assignment 5. Eight (8) classification bins 6. 15-speed bins
REQ-111	The traffic sensors shall not be used for input to vehicle transaction records. Data output from these sensors shall only be transmitted and aggregated for input to the Dynamic Pricing Engine (DPE) for use by CTRMA’s TFH operators.
REQ-112	Traffic sensor data sent in near real-time shall be timestamped when it arrives at a traffic server that parses, aggregates, and averages the raw traffic before being used by the DPE.
REQ-113	Failure to receive data from any traffic sensor shall result in a MOMS notification being generated to maintenance personnel.
REQ-114	The ETCS shall store all traffic sensor data in a database for reporting.

2.5.8 Variable Toll Message Signs (VTMS)

Table 2-21: VTMS Systems Technical Requirements

ID	RULE
REQ-115	The VTMS shall allow for a display of a minimum of six digits.
REQ-116	The VTMS system shall support all applicable VTMS business rules and performance requirements, as defined in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement.
REQ-117	The VTMS shall be connected to the ETCS roadside network (fiber-optic network) and shall display/communicate the current toll rate to motorists traveling the Express Lane Corridor.
REQ-118	The specific toll rate messages that will be displayed on these VTMS will be finalized during the design phase(s) of the project(s) to include, at a minimum, both the AVI and Pay By Mail rates.
REQ-119	If any VTMS loses communication with the TFH, an alert shall be generated in MOMS, and the VTMS will display a default message.
REQ-120	This default message shall be agreed to during the design phase of the project(s).
REQ-121	VTMS controllers shall be capable of implementing localized override commands in situations where communication may be lost to the DPE to display special pricing and or messages to motorists traveling CTRMA’s Express Lane facilities.
REQ-122	Anytime localized override commands are implemented on the VTMS, a log of those commands shall be available to CTRMA for rating or re-rating trips during the override period.
REQ-123	Communications with the VTMS shall include message acknowledgments such that messages and the content of messages (toll rates) are positively acknowledged.
REQ-124	In instances where messages or message content is not positively acknowledged, a MOMS alert will be generated, and the event will be identified in VTMS SLA reporting.
REQ-125	The VTMS shall utilize a default rate table stored locally in the sign controller. In the event communication is lost with the VTMS, the VTMS will revert to default rates. The default rate table shall be based on historical rates in increments as small as 15 minutes.

2.6 TOLL FACILITY HOST (TFH)

CTRMA requires a Toll Facility Host (TFH) system to perform the ETCS functions that meet the requirements as described herein.

The TFH will provide for the following subsystems and functionalities:

1. Dynamic Pricing
2. Image Processing (ALPR and Manual Image Review)
3. VES Image Storage
4. Trip Building
5. Reports
6. Transaction Audit Functionality
7. Interfaces
8. Express Lanes User Interface (ELUI)
9. Toll Fare Schedules Management (for Non-Express Lane Facilities)
10. ETCS User Administration
11. Exempt Vehicle List Management

The TSI is responsible for all aspects of the design, development, testing, and implementation of the TFH, which shall support applicable business rules and performance requirements as defined in Appendix 10, Lane System Business Rules, and Appendix 7, Service Level Agreement.

The TSI will provide a TFH that is fully redundant by way of high availability clustering, or by way of a failover Disaster Recovery (DR) site, cloud-based DR, or DR service.

The TFH subsystems shall be web-based and accessible by the CTRMA staff and the CTRMA-designated representatives through logins without the installation of software.

TFH must be accessible without a VPN network if accessed through CTRMA’s network and by way of a VPN/remote desktop if the user is not on the CTRMA network.

The TFH shall provide a graphical user interface (GUI) for ETCS administration and user management. In addition, the TFH shall provide the functionality to manage the exempt vehicle list and capability to store local copies of the Tag Validation List/License Plate Validation List (TVL/LVL) received from CTRMA’s DPS.

Table 2-22: General TFH Technical Requirements

ID	RULE
REQ-126	The TSI shall provide a new TFH that shall receive, aggregate, process, and report on all toll transactions from vehicles that travel through the toll lanes.
REQ-127	The TSI shall provide the software, hardware, and personnel needed to support the TFH requirements specified herein.
REQ-128	All transactions, images, and messages transferred between all subsystems shall have the required data validation controls to confirm the complete, accurate, and timely transfer of data.
REQ-129	The interaction between applications and system components shall be based on an open architecture that is decoupled, flexible, agile, scalable, and robust.

ID	RULE
REQ-130	It is preferred that the TFH software uses non-proprietary open-standard Application Programming Interfaces (APIs) that are maintained by the TSI and enables the use of or includes an industry-standard Enterprise Service Bus.
REQ-131	All TFH shall be internet browser-based.
REQ-132	The TFH shall support and define the toll rate schedule.
REQ-133	The TFH shall support user-configurable toll rate schedule(s) for transponder, registered license plate, and Pay By Mail.
REQ-134	The TFH shall provide a graphical user interface to support fixed rate fare assignment, including the ability to add, edit, and delete by user role.
REQ-135	The TFH shall only allow authorized users shall create, modify, or delete the toll rate schedules.
REQ-136	The TFH shall require an authorized user to review, accept, and transmit the toll rate schedule. However, this user shall not have the ability to create or modify any toll rate schedule.
REQ-137	The TFH shall enforce an effective begin and end date on each toll rate schedule.
REQ-138	The TFH shall enforce that only one toll rate schedule shall be in effect at any point in time.
REQ-139	A new toll rate schedule shall be in effect when its "begin date" is less than or equal to the "current date" and its "end date" is greater than the "current date."
REQ-140	The TFH shall include a web-based UI that will enable CTRMA and the TSI personnel to manage the operations of the ETCS.
REQ-141	The TFH administration system controls and configurations shall require a secure login and provide role-based access to different levels and features.
REQ-142	The TFH shall allow for a web-based UI that will enable CTRMA to manage an exempt vehicle list.
REQ-143	The TFH shall allow authorized users to add, edit, or remove vehicles individually from the exempt vehicle list or import multiple vehicles using a Comma Separated Values (CSV) file template.
REQ-144	The TFH shall allow authorized users to export a list of all exempt vehicles, including at a minimum, organization/customer name, active/inactive vehicles, effective dates, and license plate/transponder information.
REQ-145	The exempt vehicle list shall allow authorized users to group vehicles by organization /customer name.
REQ-146	The exempt vehicle list shall allow authorized users to create a group by customer/organization name.
REQ-147	The exempt vehicle list shall allow authorized users to remove an organization/customer and all associated vehicles at one time.
REQ-148	The TFH shall allow authorized users to assign license plate and/or transponder information to all vehicles.
REQ-149	The TFH shall allow authorized users to add, edit, or remove any combination of CTRMA's facilities and designated partner agency facilities (e.g., all, some, or none) to designate each facility a vehicle qualifies for an exemption.

ID	RULE
REQ-150	The TFH shall allow authorized users to transfer exempt vehicles from one customer/organization to another.
REQ-151	The TFH shall allow authorized users to assign an exemption type for each customer/organization (e.g., disabled veterans, fire/police/emergency medical services, and maintenance vehicles).

2.6.1 Dynamic Pricing

The TSI shall be responsible for the delivery and implementation of a Dynamic Pricing Engine (DPE) to support the dynamic calculation and display of toll rates through VTMS.

The TSI-provided DPE is responsible for the calculation and accuracy of the dynamic toll rates at a user-configurable interval using speed, volume, and density of the traffic.

The TSI shall determine the business rules, workflow, and dynamic pricing algorithms to meet the DPE performance through VTMS availability SLAs provided in Appendix 7, Service Level Agreement.

Table 2-23: Dynamic Pricing Technical Requirements

ID	RULE
REQ-152	The DPE shall support all applicable dynamic pricing business rules, as described in Appendix 10, Lane System Business Rules, and performance requirements, as defined in Appendix 7, Service Level Agreement.
REQ-153	The DPE shall periodically and dynamically calculate the toll rate based upon Express Lane and General Purpose (GP) Lane traffic speed, volume, density information, and Time of Day (TOD) considerations.
REQ-154	The DPE shall allow CTRMA to configure the timeframe for the toll rate calculation to execute (pricing interval). The DPS shall use a CTRMA configurable “target” LOS to drive the toll rate calculation.
REQ-155	The objective of the toll rate setting is to maintain a user-configurable minimum level of service (LOS) constraint for the Express Lane.
REQ-156	The DPE shall determine the LOS per the Highway Capacity Manual and AASHTO guidelines.
REQ-157	The DPE shall allow for the system to post variable, pre-determined rates based on time of day and day of the week.
REQ-158	The DPE shall optimize tolls for the upcoming tolling interval to maximize throughput while maintaining a level of service across the facility.
REQ-159	The DPE shall have the flexibility to consider congestion optimization.
REQ-160	The DPE shall be capable of accommodating different parameters for the determination of the toll rate based on anomalies, peak, off-peak, special events, holidays, and weekends.
REQ-161	The DPE shall allow for operators to manually override past, current, and future rates in bulk and have those override rates post to the VTMS. These override rate plans will go into effect at a user-selected timeframe (immediately, at the next pricing interval, and in the future).

ID	RULE
REQ-162	The DPE shall be able to calculate different rates by entry/exit plaza.
REQ-163	The DPE shall be capable of setting a maximum and minimum price for segments of the facility through a user-configurable parameter.
REQ-164	The DPE shall have a user-configurable minimum and maximum amount that the toll rate can increase and decrease between calculation cycles (pricing interval).

2.6.2 Image Processing (ALPR and Manual and/or Automated Image Review) and VES Image Storage

The TSI shall be responsible for all VES image capture, all VES image review, and identification of license plate number, jurisdiction, and type for all transactions on all the CTRMA facilities. All images captured and stored by the TSI-provided ETCS shall be subject to CTRMA’s Data Retention Policy provided in Appendix 12. CTRMA requires a double-blind review of each image when images are manually reviewed and requires that one of these double-blind reviews is completed by human review or by an approved automated method

The TSI can propose an automated image review method that meets the Image Processing System (IPS) performance and accuracy SLAs provided in Appendix 7. CTRMA will review and approve or reject the use of an automated method for image reviews. If after the approval for use of the automated image review method, and if at any time it is found to be not in compliance with SLA AC6, SLA AC5 and SLA SP 3 from Appendix 7 Service Level Agreement, CTRMA will suspend the use of the automated image review method at the same contracted price.

The TSI shall determine the business rules, workflows, and processes for the VES image review required to meet the Image Processing System (IPS) performance and accuracy SLAs provided in Appendix 7. These business rules, workflows, and processes shall be included in the design documents submitted by the TSI.

The TSI shall record a code-off code when the automated or manual review fails to return a license plate result for all processed transaction images. The code-off codes shall be agreed upon with CTRMA to ensure consistency in monitoring and reporting. The method of assigning a code-off code, when multiple reasons for failure are present shall be agreed upon with CTRMA to ensure system-caused, and vehicle-caused errors are monitored and reported on consistently.

The output of the image review process shall contain the following data elements: license plate number, jurisdiction, plate type, ROI coordinates, ALPR confidence, code-off codes (if applicable), and the date and time. These data elements containing the final license plate result are then assigned to the transaction record.

CTRMA shall have the ability to see the review history of all images processed in the IPS.

The TSI shall be responsible for capturing the image transactions through the VES and storage of images in separate digital files in an open-standard file architecture linked to the transaction record.

The TSI shall proactively manage and report to CTRMA any potential image processing backlogs. This reporting shall ensure CTRMA is aware of any possible delays in manual image review queues or systematic image processing that may impact revenue or downstream operational processes (e.g., delays in interoperability or Pay By Mail processing).

The IPS shall include image audit functionality for CTRMA to assess the accuracy and performance of the system. The IPS shall adhere to the following requirements:

Table 2-24: Image Processing System Technical Requirements

ID	RULE
REQ-165	The IPS shall support all applicable image processing business rules in Appendix 10, Lane System Business Rules, and performance requirements, as defined in Appendix 7, Service Level Agreement.
REQ-166	The IPS shall support audit functionality to measure the accuracy of license plate results and code-off accuracy at defined intervals or as desired by CTRMA and provide results via dashboards and reports.
REQ-167	The IPS shall have a GUI/screen to allow for the creation of audit sets and to view all the audit sets in a user’s audit setlist.
REQ-168	This screen shall show the following fields for each of the audit sets: <ol style="list-style-type: none"> 1. Audit Set ID 2. Audit Set Name 3. Created Date 4. Last Audited Date 5. Completed Date 6. Status of the audit (e.g., in progress, completed, created) 7. Number of images audited 8. Number of images remaining to be audited
REQ-169	The screen shall allow an audit user to view the details of the underlying image transaction contained in the audit set.
REQ-170	The IPS shall allow an audit user or audit manager the ability to create an audit set with a configurable number of random images with the following criteria: <ol style="list-style-type: none"> 1. A selectable date range based on the transaction date 2. Facility 3. Direction 4. Plaza 5. Lane 6. Jurisdiction 7. Plate Type 8. Image Failure Code

ID	RULE
REQ-171	<p>The IPS shall allow an audit manager to create an audit set with a configurable number of random images from completed image audits performed by an audit user. The audit set creation criteria shall be selected with the following criteria:</p> <ol style="list-style-type: none"> 1. A selectable date range based on the transaction date 2. A selectable date range based on the audited date 3. Facility 4. Direction 5. Plaza 6. Lane 7. Jurisdiction 8. Plate Type 9. Image Failure Code 10. Audit Set ID 11. Auditor
REQ-172	<p>For all audit sets sent to audit users and audit managers, the IPS shall store all the audit set creation information as a unique record for retrieval. This information shall be available in the reporting system.</p>
REQ-173	<p>The IPS shall allow IPS audit users to modify, delete, and archive audit sets in their audit setlist. The following conditions apply to audit sets:</p> <ol style="list-style-type: none"> 1. A modification shall only be available if the audit set has not yet been started 2. The image processing system shall denote audit sets that have been deleted by the audit users 3. Completed audit sets shall not be deleted 4. Archived audit sets shall be hidden from view in the audit set GUI but shall be reported on in the reporting system. Only completed audit sets shall be achievable
REQ-174	<p>The IPS shall allow audit users to audit any audit set, in their audit set list, in any order.</p>
REQ-175	<p>The IPS shall allow audit users to review an audit set.</p>
REQ-176	<p>The IPS shall allow audit users to partially review an audit set. Partially reviewed audit sets are not considered complete, but in-progress.</p>
REQ-177	<p>The IPS shall allow audit managers to assign audit sets to audit users.</p>

ID	RULE
REQ-178	<p>The IPS shall provide an IPS audit set schedule screen to allow users to schedule the creation of audit sets.</p> <ol style="list-style-type: none"> 1. Audit scheduling shall allow audit users to schedule audit set creation based on relative dates from the transaction date, including the following: <ol style="list-style-type: none"> a. Last day b. Last week c. Last month d. A configurable number of days/weeks/months before the current date 2. Audit scheduling shall allow audit users to schedule the creation of audit sets at different frequencies, including the following: <ol style="list-style-type: none"> a. Daily, by the time of day b. Weekly, by the day of the week c. Monthly, by the date of the month 3. Audit scheduling shall allow users to configure start and end dates for the audit schedule <ol style="list-style-type: none"> a. If an end date is not specified, the schedule shall run indefinitely until an audit user manually ends the schedule 4. If an audit user modifies a schedule, changes to the schedule shall be in effect upon the completion of the modification to the schedule 5. Audit set schedule screen shall allow users to see schedules they created, including the following: <ol style="list-style-type: none"> a. Created date b. Modified date c. Schedule end date d. Schedule details 6. The IPS shall alert the user that created the schedule when the following occurs: <ol style="list-style-type: none"> a. The IPS successfully created an audit set b. The IPS failed to create an audit set

ID	RULE
REQ-179	<p>The review audit set screen shall have the following functionality:</p> <ol style="list-style-type: none"> 1. The color image associated with the highest system accuracy score is to be presented as the initial image for the IPS audit users. If an image set has no score result, the brightest color image is to be presented as the initial image for the IPS audit users. 2. The Region of Interest (ROI) of the vehicle must be from the best and most likely image displayed and must be displayed in a large view, with other possible images associated with the transactions displayed on the same screen in smaller views. 3. Mouse button use is strictly limited to tasks such as choosing the image and ROI, if necessary. Most operator functions shall be done through a single or limited keystroke(s) and will not require a mouse (e.g., use of “hot” keys). 4. Display the transaction information related to the image set, including the following: <ol style="list-style-type: none"> a. Date b. Time c. Location (e.g., Facility, Plaza, Lane Number, Camera ID) d. Transponder ID and agency if available e. Transaction ID 5. The final license plate result or code-off code is to be displayed with the associated image set. 6. The IPS audit users shall be able to pass, fail, or skip transactions. <ol style="list-style-type: none"> a. Pass is when an IPS audit user agrees with the presented license plate result or image failure code b. Fail is when an IPS audit user disagrees with the presented license plate result or image failure code c. Skip is when an IPS audit user can neither agree nor disagree with the presented license plate result or image failure code 7. In the event where the IPS audit user fails the transaction, the user must submit a failure reason code for failing the transaction. 8. Failure reason code shall be configurable by CTRMA. 9. An auditor shall have the ability to go back and edit at least the last ten transactions processed by the audit user. 10. The system shall auto-save review results after a minute of inactivity. 11. The system shall provide on-screen tools to allow user adjustment of color, contrast, and brightness.
REQ-180	The IPS shall have search tools to locate images and data in the database.
REQ-181	Search results shall allow for the display of images (as in a gallery), data, or both.
REQ-182	Search results shall have the capability to be exported in HTML, PDF, CSV, and excel formats to the user’s desktop or other location.
REQ-183	The search results shall be capable of being selected individually or as a subset of the data set for export.

ID	RULE
REQ-184	Search criteria shall include but will not be limited to date/time/range, locations (facility, plaza), lane(s), transponder ID, license plate, jurisdiction, camera ID, transaction ID, ALPR/VSR performance value ranges, transaction status and other criteria developed during the design phase.
REQ-185	The IPS shall record an image failure code to denote the reason for a vehicle’s license plate not being captured or an illegible image for all image-based transactions which are not processed. The codes for unprocessed images shall be agreed upon by CTRMA to ensure consistency in monitoring and reporting.
REQ-186	The IPS shall monitor and report on the quality of images received from the toll lanes in a manner that allows for the quick escalation of in-lane camera issues, ALPR issues, or vehicle framing issues.
REQ-187	The IPS shall store images in their native format (as received) as well as any ALPR information and transaction data provided by the Zone Controller.
REQ-188	The IPS shall process transactions/images in a First-In-First-Out (FIFO) manner.
REQ-189	The IPS shall provide for human/manual review of images with license plate numbers (LPN) and jurisdiction (state) input.
REQ-190	The IPS shall provide the capability to audit reviewers and track reviewer performance. If an optional automated method for image review is approved, the IPS shall provide the capability to audit the automated reviews and track the automated review performance
REQ-191	The IPS shall assign a confidence level or threshold to identify images that require manual review.

2.6.3 Trip Building

The TFH shall include a trip building system to logically group transaction records received from the roadside system(s) into trips. The TSI shall record all the Toll Point events and assemble them into complete Toll Point transactions from the roadside. The TSI shall then transmit all individual Toll Point transaction data to the TFH. The TFH receives individual Toll Point transaction data and then assembles this data into the logical trip and determines the appropriate toll rate. Refer to CTRMA’s trip building business rules in Appendix 10 for additional information.

Table 2-25: Trip Building Technical Requirements

ID	RULE
REQ-192	The trip building system shall support all applicable trip building business rules, as described in Appendix 10, Lane System Business Rules, and performance requirements, as defined in Appendix 7, Service Level Agreement.
REQ-193	The trip building system shall create trips consisting of one or many individual transactions based on facility, the matching images, transponder, and other available transaction information for each vehicle passing through the facility.
REQ-194	The trip building system shall assign a unique trip ID to each trip.

ID	RULE
REQ-195	Trips will be built based on a CTRMA user-configurable entry/exit plaza where a vehicle was detected (either AVI or LPN) in the Express Lane.
REQ-196	Trips may be based on AVI reads, LPN matches, or a combination of the two.
REQ-197	All trips created by the TSI-provided trip building process will be sent to CTRMA’s Data Platform system for final disposition, posting, and processing per the TFH to Data Platform Host transaction interface to be developed and approved by CTRMA during the design phase of this project.
REQ-198	The trip building system shall provide the capability to review, audit, and correct formed trips based on user-configurable conditions and selection criteria.
REQ-199	The trip building process shall include a user-configurable dwell or hold time wherein trips are not sent to CTRMA’s Data Platform System until this dwell or hold time has been met, allowing CTRMA to adjust, re-rate, and otherwise disposition trips.
REQ-200	The trip building process shall include a user-configurable processing time, is automatically adjusted based on current system conditions (e.g., failures), and is added to the dwell time.
REQ-201	The trip building process shall include a user-configurable lapse time to define the maximum travel time allowed for a trip.
REQ-202	The trip building system shall allow CTRMA to override toll rates on batches of trips based on facility, period, segments, and entry/exit combination.
REQ-203	Trip building is limited to a single facility and direction. Trips will not cross facilities.
REQ-204	The trip building system shall include a transponder-to-license plate correlation to improve trip building accuracy. Whenever this correlation determines that the transponder and license plate contained in any transaction based on vehicle identification processing, one of the transactions becomes an exception. The specific function and implementation of this filter will be finalized during the design phase.

2.6.3.1 Transaction Aggregation

Note: CTRMA will determine if Transaction Aggregation functionality shall be implemented.

Table 2-26: Transaction Aggregation Technical Requirements

ID	RULE
REQ-205	Provide a CTRMA configurable “switch” that allows existing facilities that are not trip-based to become trip based.
REQ-206	This switch will be at the facility level, where CTRMA can select the facility.
REQ-207	If this switch is turned “on”, then the selected facility will bundle/aggregate transactions from that facility into a trip.
REQ-208	The trip will be made up of all the transactions from the plazas on that facility where a vehicle was detected.
REQ-209	This trip will be formed after image review of the separate transactions so that LPN is known.

ID	RULE
REQ-210	If LPNs, or transponder numbers do not match in the transactions, they will not be bundled/aggregated into a trip.
REQ-211	The toll rate will be the summation of the toll rates applied to the transactions that are bundled/aggregated into the trip.
REQ-212	There will be a CTRMA configurable time limit around the transactions that are to be bundled/aggregated (i.e., only bundle/aggregate transactions that are within X number of minutes from beginning to end). These bundled/aggregated transactions are only one-directional.
REQ-213	The bundled/aggregated transaction will be sent to the Data Platform System as a single trip, with the summed-up toll rate.

2.6.3.2 Trip Review GUI

Table 2-27: Trip Review GUI Technical Requirements

ID	RULE
REQ-214	The trip building system shall include trip search criteria that include the following: <ol style="list-style-type: none"> 1. Date/Time 2. Facility 3. Direction 4. Lane ID 5. Plaza 6. Origin-Destination Pair 7. Transponder Number 8. License Plate Number 9. Trip ID 10. Transaction Number 11. Trip Type 12. Trip Status 13. Toll Rate 14. Vehicle Class
REQ-215	The trip building GUI shall include search results that shall be sortable and filterable by column headings on the search results screen.
REQ-216	The trip building GUI shall include a count of the total number of records returned that match the entered search criteria.
REQ-217	The trip building GUI shall provide for a trip detail drill down that contains the additional transaction information, at a minimum: <ol style="list-style-type: none"> 1. Transaction date/time 2. Transaction location (Facility, Plaza) 3. License plate/transponders read in each transaction 4. Link to image sets

ID	RULE
REQ-218	Authorized CTRMA users shall be able to select a single trip or a batch of trips from the search results and perform the following actions: <ol style="list-style-type: none"> 1. Re-rate trips 2. Adjust trips (change license plate, vehicle class, etc.) 3. Split trips 4. Merge trips 5. Write off trips
REQ-219	Authorized CTRMA users shall be to view the max rate (or highest rate), including travel times savings for a given time.

2.6.3.3 Toll Rate Assignment

Table 2-28: Toll Rate Assignment Technical Requirements

ID	RULE
REQ-220	The trip building system shall support applicable toll rate assignment business rules as described by Appendix 10, Lane System Business Rules, and performance requirements, as defined in Appendix 7, Service Level Agreement.
REQ-221	Toll rates shall be assigned to trips based on the price displayed on the VTMS before the entry to the facilities.
REQ-222	The trip building process shall determine the toll rate for each Express Lane trip based on the segment(s) traversed by the vehicle.
REQ-223	The assigned toll rate shall reflect the transaction type (e.g., valid AVI or Pay By Mail).
REQ-224	The toll rate assigned to a trip shall be the rate in effect per the DPE and displayed on the VTMS at the time the vehicle enters any Express Lanes facility or any segment thereof.
REQ-225	The TFH shall record and retain all toll rates and other messages exchanged with the VTMS for a minimum of three (3) months.
REQ-226	The TFH shall maintain a backup toll rate schedule based on the previous three (3) months of historical data, and it shall be applied as the default toll rate schedule in the event communication is lost between the TFH and DPE.
REQ-227	The TFH shall support preapproved manual override functionality for non-express lanes.

2.6.4 Reports

The TSI shall develop and deliver a reporting system to support roadside, the TFH, maintenance subsystems, and overall systems availability and performance reporting.

The TSI shall collaborate with CTRMA’s internal stakeholders and other third parties as directed by CTRMA for purposes of designing, developing, and testing transaction reconciliation reporting, which may include the comparison of reports from multiple vendors. For example, the TSI may be required to coordinate with CTRMA’s traffic and revenue consultant on which reports (and data elements) should be developed and used in support of contracted services provided to CTRMA. The SLAs shall govern report generation execution times and data output limits defined in Appendix 7, Service Level Agreement.

In addition to the TSI’s standard suite of reports, as defined in Section 2.6.4.1, Categories of Reports, and custom reports developed as part of Section 2.7.4, Report Development Workshops, the TSI shall deliver reports representative of items described in Appendix 14, Key Reports.

The TSI may utilize existing reports to satisfy the requirements of Appendix 14, Key Reports, if acceptable to CTRMA. The TSI will coordinate with CTRMA during the Reports Development Workshop to determine which reports may be satisfied by utilizing reports in the TSI’s current reporting suite, and any modification or new development required. The TSI shall provide a Reports Detailed Design Document to document the design as a result of the workshop.

The TSI shall provide a reporting system with the functionality of the reports scheduler to schedule automated reports delivered to a configured location.

Table 2-29: Report Technical Requirements

ID	RULE
REQ-228	The reporting system shall support all applicable reporting business rules in Appendix 10, Lane System Business Rules, and performance requirements, as defined in Appendix 7, Service Level Agreement.
REQ-229	Transaction and trip, reconciliation, maintenance, performance (e.g., SLAs), configuration management, asset management, operational (IPS) audit, and security reports shall all be available to CTRMA on a daily, weekly, and monthly basis. Report formats shall be developed and approved during the design phase of the project and shall include standard, (within limits) ad-hoc report generation capability, and dashboard reports.
REQ-230	The user interface shall provide the capability to select and review videos based on the timeframe, location (facility/plaza/lane), tag number, vehicle class, transaction number. The user interface shall allow the selected video to be replayed in real-time, in slow motion, frame by frame. The user interface will allow the user to “scroll” through the selected video with a pointing device (i.e., mouse).
REQ-231	The reporting system shall support full transaction-level reconciliation and audibility from the TSI-provided roadside, the TFH systems, and ETCS subsystems to externally connected external systems.
REQ-232	The reporting system shall provide the capability to schedule and deliver scheduled reports to the configured destination or be run on-demand.
REQ-233	The reporting system shall provide the capability for the user to specify the format of the report, for example, PDF, Excel, and CSV.
REQ-234	The reporting system shall perform the daily system checks to ensure system reports and automatically generated reports are complete and not missing any data.
REQ-235	The reporting system shall generate an alert when data is missing, or a report summarization has failed.
REQ-236	The reporting system shall allow for efficient export/extraction of large raw data sets for use by CTRMA’s engineering, finance, traffic, and revenue consultants, and other third parties as required by CTRMA for data analysis. Specific requirements for the method and format of these data extracts will be defined during the design phase of the project.

2.6.4.1 Categories of Reports

Detailed report requirements shall be defined during the requirements and design phases of the project. Report categories shall include, but are not limited to, the following:

2.6.4.1.1 Audit and Reconciliation Reports

Table 2-30: Audit and Reconciliation Reports Technical Requirements

ID	RULE
REQ-237	The required audit and reconciliation reports include the following, at a minimum: <ol style="list-style-type: none"> 1. Exception Reports 2. Interface and File Transmission Reconciliation Reports 3. Revenue Audit and Reconciliation 4. Transaction Audit and Reconciliation 5. User Access, Activity, and Data Modification Reports 6. Reconciliation Summary Report

2.6.4.1.2 Maintenance Reports

Table 2-31: Maintenance Reports Technical Requirements

ID	RULE
REQ-238	The required maintenance reports include the following, at a minimum: <ol style="list-style-type: none"> 1. Asset Value and Depreciation 2. Availability and Performance Statistical Reports 3. Emergency Maintenance 4. Equipment Health 5. Equipment Inventory and Tracking 6. Equipment Use, Failure, Warranty, and Repair History 7. Incidents Log 8. Scheduled Preventive Maintenance Tasks 9. Preventive Maintenance Activity 10. Response and Repair Times 11. Alarms History 12. Trend Analysis 13. Comparative Analysis 14. SLA Metrics 15. Equipment, Interface, Subsystem, and Total System Availability 16. Work Order Status and Tracking

2.6.4.1.3 Network Monitoring Reports

Table 2-32: Network Monitoring Reports Technical Requirements

ID	RULE
REQ-239	The required network monitoring reports include the following, at a minimum: <ol style="list-style-type: none"> 1. Uptime Chart 2. Activity Report 3. Managed Device Inventory 4. All Alerts 5. All Down Alerts 6. Network Health 7. Server Health 8. Server Performance 9. WAN Activity 10. Backup Monitoring 11. Preventative Maintenance

2.6.4.1.4 IPS Reports

Table 2-33: IPS Reports Technical Requirements

ID	RULE
REQ-240	The required IPS reports include the following, at a minimum: <ol style="list-style-type: none"> 1. Image Disposition Summary and Detail 2. Image Status Summary and Detail 3. Operational by Queue (including the current state of all transactions) 4. QA Reports 5. End-to-End Historical Reports (for total transactions processed) 6. Filter Reports 7. Image Review Performance-Detail Report 8. Image Code-off Summary Report 9. Image Rejections by User 10. User Statistics Detail and Summary Report 11. Rejected Images by Reviewer Report

2.6.4.1.5 Transaction and Trip Reports

Table 2-34: Transaction and Trip Reports Technical Requirements

ID	RULE
REQ-241	<p>The required transaction and trip reports include the following, at a minimum:</p> <ol style="list-style-type: none"> 1. Detailed Transactions and Trip reports that shall consist of all transactions received by the toll facility. These reports shall report daily, weekly, monthly, and yearly transactions and revenue by the facility. 2. Detailed transaction and trip report(s) shall be by facility/direction/lane and include the following fields, at a minimum: <ol style="list-style-type: none"> a. Transaction ID b. Transponder number(s) c. Transponder status d. Transponder agency e. Plate number, state, and type (as applicable) f. Image URLs g. Vehicle classification h. Toll rate i. Date/time j. Location (e.g., entry and exit plazas) k. Processing (workflow) status 3. Transaction and Trip Processing Reports, which includes the processing status (workflow) 4. Summary and detail of transactions/trips posted to the BOS accounts. Summaries are provided in daily, weekly, monthly, and yearly increments. 5. Transaction and Trip Adjustment Report, which includes before and after transaction details, modified by User ID and reason for the adjustment. 6. Transaction and trip type summary 7. Travel time report based on transponder reads/timestamps. 8. Reporting capability to quantify vehicles traveling in a contiguous trip across facilities for a given time 9. Reporting capability to quantify vehicles by the origin and destination in a contiguous trip across facilities, for a given time 10. Administrative reports <ol style="list-style-type: none"> a. Report scheduler b. Exempt vehicles c. Special programs

2.6.4.2 Automated and Ad-Hoc Data Extracts

In support of CTRMA’s consultants and auditors, the TSI shall provide a method for efficient and automated data extraction for data analysis and monitoring the performance of CTRMA’s express lanes and non-express lane facilities, and for future traffic and revenue studies. Data shall be made available to CTRMA’s consultants via an interface where possible, as described in Section 2.6.6, Interfaces. The format of the data required is described in the following Sections 2.6.4.2.1 through 2.6.4.2.4.

2.6.4.2.1 Transponder Data

- **Frequency:** Monthly (estimated)
- **Detail:** Individual Electronic Toll Collection (ETC) transactions recorded at plaza level
- **Method:** Direct access/interface to the ETCS for automated data extracts as needed

GANTRY LOCATION	PLAZAID	LANENUM	TRANSTMST	PLAZATRXID	AXLES	EXPECTEDAMOUNT	AGENCY	TAGID
Enfield NB	80		1 10/28/2018 00:00:14.395026000	5321XXXX	2	0.40	TxDOT	TEX.XXXY01
Enfield NB	80		1 10/28/2018 00:00:28.097047000	5321XXXX	2	0.40	TxDOT	TEX.XXXY02
Enfield NB	80		1 10/28/2018 00:01:05.507653000	5321XXXX	2	0.40	TxDOT	TEX.XXXY03
Enfield NB	80		1 10/28/2018 00:02:14.115648000	5321XXXX	2	0.40	TxDOT	TEX.XXXY04
Enfield NB	80		1 10/28/2018 00:03:33.087806000	5321XXXX	2	0.40	TxDOT	TEX.XXXY05
Enfield NB	80		1 10/28/2018 00:04:20.856466000	5321XXXX	2	0.40	TxDOT	TEX.XXXY06
Enfield NB	80		1 10/28/2018 00:04:45.703069000	5321XXXX	2	0.40	TxDOT	TEX.XXXY07
Enfield NB	80		1 10/28/2018 00:05:04.172022000	5321XXXX	2	0.40	TxDOT	TEX.XXXY08
Enfield NB	80		1 10/28/2018 00:05:23.862593000	5321XXXX	2	0.40	TxDOT	TEX.XXXY09
Enfield NB	80		1 10/28/2018 00:05:43.814022000	5321XXXX	2	0.40	TxDOT	TEX.XXXY10
Enfield NB	80		1 10/28/2018 00:06:26.834841000	5321XXXX	2	0.40	NTTA	TEX.XXXY11
Enfield NB	80		1 10/28/2018 00:06:58.071675000	5321XXXX	2	0.40	TxDOT	TEX.XXXY12
Enfield NB	80		1 10/28/2018 00:07:10.331035000	5321XXXX	2	0.40	TxDOT	TEX.XXXY13
Enfield NB	80		1 10/28/2018 00:07:41.599659000	5321XXXX	2	0.40	TxDOT	TEX.XXXY14
Enfield NB	80		1 10/28/2018 00:07:42.421811000	5321XXXX	2	0.40	TxDOT	TEX.XXXY15
Enfield NB	80		1 10/28/2018 00:07:43.176027000	5321XXXX	2	0.40	TxDOT	TEX.XXXY16
Enfield NB	80		1 10/28/2018 00:08:06.479063000	5321XXXX	2	0.40	TxDOT	TEX.XXXY17
Enfield NB	80		1 10/28/2018 00:08:25.128981000	5321XXXX	2	0.40	TxDOT	TEX.XXXY18
Enfield NB	80		1 10/28/2018 00:08:48.905841000	5321XXXX	2	0.40	TxDOT	TEX.XXXY19

Figure 2-16: Transaction Data

2.6.4.2.2 License Plate Data

- **Frequency:** Monthly (estimated)
- **Detail:** Individual Pay By Mail transactions recorded at plaza level
- **Method:** Direct access/interface to the ETCS for automated data extracts as needed

GANTRY LOCATION	PLAZAID	LANENUM	TRANSTMST	PLAZATRXID	AXLES	TOLLAMOUNT	PLATESTATE	PLATENUM	TAGAGENCYID	TAGID	AMOUNTDUE
Enfield NB	80		1 10/28/2018 00:01:12.967566000	5321XXXX	2	0.33	TX	XXXXXXXX01			
Enfield NB	80		1 10/28/2018 00:04:50.482555000	5321XXXX	2	0.33	TX	XXXXXXXX02			
Enfield NB	80		1 10/28/2018 00:06:52.715719000	5321XXXX	2	0.33	TX	XXXXXXXX03			
Enfield NB	80		1 10/28/2018 00:07:56.663478000	5321XXXX	2	0.33	TX	XXXXXXXX04			
Enfield NB	80		1 10/28/2018 00:08:00.623151000	5321XXXX	2	0.33	TX	XXXXXXXX05			
Enfield NB	80		1 10/28/2018 00:09:35.800410000	5321XXXX	2	0.33	TX	XXXXXXXX06			
Enfield NB	80		1 10/28/2018 00:10:06.027322000	5321XXXX	2	0.33	TX	XXXXXXXX07			
Enfield NB	80		1 10/28/2018 00:10:12.838303000	5321XXXX	2	0.33	TX	XXXXXXXX08			
Enfield NB	80		1 10/28/2018 00:14:19.386830000	5321XXXX	2	0.33	TX	XXXXXXXX09	102	TEX.XXX01	0.25
Enfield NB	80		1 10/28/2018 00:15:15.635741000	5321XXXX	2	0.33	TX	XXXXXXXX10			
Enfield NB	80		1 10/28/2018 00:18:03.455570000	5321XXXX	2	0.33	OK	XXXXXXXX11	103	TEX.XXX02	0.25
Enfield NB	80		1 10/28/2018 00:21:48.676126000	5321XXXX	2	0.33	TX	XXXXXXXX12			
Enfield NB	80		1 10/28/2018 00:21:50.919753000	5321XXXX	2	0.33	TX	XXXXXXXX13			
Enfield NB	80		1 10/28/2018 00:22:30.301762000	5321XXXX	2	0.33	TX	XXXXXXXX14			
Enfield NB	80		1 10/28/2018 00:23:37.247370000	5321XXXX	2	0.33	TX	XXXXXXXX15	103	TEX.XXX03	0.25
Enfield NB	80		1 10/28/2018 00:24:58.335001000	5321XXXX	2	0.33	TX	XXXXXXXX16			
Enfield NB	80		1 10/28/2018 00:25:09.171669000	5321XXXX	2	0.33	TX	XXXXXXXX17	101	TEX.XXX06	0.25
Enfield NB	80		1 10/28/2018 00:28:22.136695000	5321XXXX	2	0.33	TX	XXXXXXXX18			
Enfield NB	80		1 10/28/2018 00:30:39.512951000	5321XXXX	2	0.33	TX	XXXXXXXX19			

Figure 2-17: License Plate Data

2.6.4.2.3 Transactions and Revenue Data

- **Detail:** Daily transactions and estimated revenue by AVI and video by the plaza
- **Method:** Daily reports (emailed)
- Current transaction and revenue data format

Plaza ID	Plaza Name	AVI Count	AVI Estimated Revenue	PBM Count	PBM Estimated Revenue
80	Enfield NB	1387	485.45	1015	537.95
81	Far West NB	778	272.3	699	370.47
82	Parmer SB	500	175	409	216.77
83	RM2222 SB	1307	457.45	1045	553.85
	Total	3972	1390.2	3168	1679.04

Figure 2-18: Transactions and Revenue Data

2.6.4.2.4 Revenue Recovery Statistics

- **Detail:** Daily revenue data for transponder, I-Toll, and video transactions
- **Method:** Daily reports (emailed)
- Current revenue recovery data format

DAY_MONTH	Day	Is_WeekDay	HR24	MINUTES	ID	TOT_TRANS	TAG_TRANS	PENETRATION_%
01-FEB-2019	5	1	0	0	01-FEB-2019_0_0	38.00	11.00	29.00
01-FEB-2019	5	1	0	15	01-FEB-2019_0_15	24.00	6.00	25.00
01-FEB-2019	5	1	0	30	01-FEB-2019_0_30	27.00	3.00	11.00
01-FEB-2019	5	1	0	45	01-FEB-2019_0_45	17.00	4.00	24.00
01-FEB-2019	5	1	1	0	01-FEB-2019_1_0	14.00	3.00	21.00
01-FEB-2019	5	1	1	15	01-FEB-2019_1_15	7.00	2.00	29.00
01-FEB-2019	5	1	1	30	01-FEB-2019_1_30	8.00	3.00	38.00
01-FEB-2019	5	1	1	45	01-FEB-2019_1_45	8.00	2.00	25.00
01-FEB-2019	5	1	2	0	01-FEB-2019_2_0	11.00	2.00	18.00
01-FEB-2019	5	1	2	15	01-FEB-2019_2_15	11.00	3.00	27.00
01-FEB-2019	5	1	2	30	01-FEB-2019_2_30	12.00	5.00	42.00
01-FEB-2019	5	1	2	45	01-FEB-2019_2_45	3.00	1.00	33.00
01-FEB-2019	5	1	3	0	01-FEB-2019_3_0	9.00	4.00	44.00
01-FEB-2019	5	1	3	15	01-FEB-2019_3_15	7.00	2.00	29.00
01-FEB-2019	5	1	3	30	01-FEB-2019_3_30	9.00	1.00	11.00
01-FEB-2019	5	1	3	45	01-FEB-2019_3_45	7.00	2.00	29.00
01-FEB-2019	5	1	4	0	01-FEB-2019_4_0	9.00	2.00	22.00
01-FEB-2019	5	1	4	15	01-FEB-2019_4_15	7.00	1.00	14.00
01-FEB-2019	5	1	4	30	01-FEB-2019_4_30	21.00	0.00	0.00

Figure 2-19: Revenue Recovery Statistics

2.6.5 System Security and Transaction Audit

The TFH shall provide audit trails and audit functionality for all transaction/trip processing activity that is performed by the system either automatically or by users. A screen/report shall be provided that allows authorized users to understand all changes made to a transaction/trip and the User ID associated with these changes. System changes shall be included with an appropriate User ID. This screen/report will include selection criteria such as period, location (facility, plaza), and other criteria such that specific system audits can be performed.

The TSI shall provide technical resources, ad-hoc reporting support, and TSI facilitated meetings to explain system functionality to CTRMA’s designated auditors. This support shall be addressed with the highest priority and may include working with third parties.

Table 2-35: System Security Technical Requirements

ID	RULE
REQ-242	Only authorized personnel with assigned User IDs and passwords shall have access to computers, applications, and system information on the ETCS computers and network.
REQ-243	The system shall provide controlled user access that includes sign-on facilities, permission control, and various levels or roles for access to system control, files, directories, and application software, including logs of user account modification (e.g., add, delete, changes) made available for review and audit.
REQ-244	The system shall support changes by CTRMA to the access levels and personnel designated to those roles.
REQ-245	The system shall include features to assure the security and integrity of all data collected and processed by the system.
REQ-246	The system shall employ redundancy as needed to meet the required availability and functionality requirements and to protect against data loss and data corruption. Communication transmissions to and from the system shall employ a reliable means of confirming that data is accurately sent and received.
REQ-247	If not using SaaS or cloud-based platforms, the system shall protect against data loss caused by equipment malfunction and failure, inadequate data storage capacity, communication loss, power outage, voltage drop or surges, extreme temperatures, deletion by users or other forms of human error, and cyber-attacks (i.e., rogue users/hackers, virus attacks).
REQ-248	Throughout all levels of the system, the TSI shall employ an integrated and comprehensive anti-spam and anti-virus protection system.
REQ-249	The TSI shall provide a secure firewall that protects all aspects of the system.
REQ-250	Any modifications to data (records) and all databases shall be recorded to a retrievable chronological log that includes notations to support system audits.
REQ-251	The TSI shall not disclose, distribute or make available to any third party the names, addresses, or any other personal identification information of customers without their express consent except as required to comply with laws or legal processes served for CTRMA.
REQ-252	Any vulnerabilities shall be immediately reported to CTRMA along with any recommended patches, upgrades, and enhancements to the system.
REQ-253	The TSI shall perform periodic cybersecurity testing and vulnerability assessments to be planned and coordinated with CTRMA. Vulnerability testing shall be performed monthly, as well as with every new software release or addition of new network equipment.
REQ-254	The TFH shall provide audit trails and audit functionality for all transaction processing activity that is performed by the system either automatically or by users.
REQ-255	A screen/report shall be provided that allows authorized users to understand all changes made to a transaction and the User ID associated with these changes.
REQ-256	System changes shall be included with an appropriate User ID.

ID	RULE
REQ-257	This screen/report shall include selection criteria such as time, location (facility, plaza), and other criteria such that specific system audits can be performed.
REQ-258	The TFH shall include functionality to audit all roadside transactions.
REQ-259	A GUI shall be provided that allows authorized users to select a date, time, location (facility, plaza), and other criteria to audit transactions from the roadside and received by the TFH.
REQ-260	The results of all roadside transaction audits shall be included in reports that contain relevant roadside information and relevant TFH information available in Excel or CSV formats.
REQ-261	<p>The specific data elements that will be contained in these audit reports shall be agreed to during the design phase but shall include the following, at a minimum:</p> <ol style="list-style-type: none"> 1. Roadside Transaction (sent) <ol style="list-style-type: none"> a. Date and time b. Location (facility, plaza) c. Transaction ID d. Transponder numbers e. LPN 2. TFH (received) <ol style="list-style-type: none"> a. Date and time b. Location (facility, plaza) c. Transaction ID d. Transponder numbers e. LPN
REQ-262	These audit reports shall include summary numbers as well that indicate the numbers of transactions sent for the selection criteria and the number of transactions received for the selection criteria.
REQ-263	The TSI shall provide support for audits requested by CTRMA.
REQ-264	The TSI shall arrange and perform an annual SSAE 16 (SOC 1) Type II audit for submittal to CTRMA, which shall be considered part of the work involving no additional cost. The audit shall focus on security (including delineation of responsibility), availability, processing integrity, confidentiality, and privacy. The TSI shall address and correct any deficiencies discovered during the audit.
REQ-265	All system administrators shall have two separate user accounts. One will be a standard user-level account to be used for regular activities that do not require root or administrator-level permissions. The other account shall be a root or administrator-level account, which shall only be used for activities that require root or administrator-level permissions.
REQ-266	The TSI shall provide, at their cost, an annual information security risk assessment to be performed by a third party approved by CTRMA. The TSI shall provide the assessment results to CTRMA. The first risk assessment shall be completed prior to system integration testing.
REQ-267	The TSI is responsible for correcting all toll system security deficiencies at the TSI's cost and ensuring that all security risks are mitigated to a level that is acceptable to CTRMA.

ID	RULE
REQ-268	The TSI shall maintain a development and test environment, separate from the production system, for any systems development and testing needs (i.e., there shall always be a separation of production and development environments).
REQ-269	The TSI shall implement encryption of all data at rest and in transit, exclusive of RFID communications. This encryption shall meet the most recent National Institute of Standards and Technology (NIST) standards, the most current being detailed in NIST Special Publication 800-175B Revision 1.

2.6.6 Interfaces

The TSI shall provide interfaces designed to exchange data between the TFH and CTRMA’s DPS and third-party service providers. As part of the requirements phase for the project, the TSI shall define a list of interfaces and related requirements for the project. During the design phase, the TSI shall develop appropriate ICD’s for the review, comment, and approval by CTRMA.

These ICDs shall fully describe the interfaces (or APIs if appropriate), including file formats, message delivery guarantee structure and receipt acknowledgment, error checking and handling, retransmission procedures, archiving, and other related specifications.

These ICDs shall address the physical, functional, and performance aspects of all interfaces. Data flow diagrams shall be used to illustrate the objectives of the interface, and any proposed security protection consistent with the public exposure of the interface data shall be described.

The TSI shall prepare and maintain for the duration of the contract an interface specification catalog. This catalog will include, at a minimum, every interface name, its purpose, who builds/built it, who maintains it, latest ICD, or Web Services Description Language (WSDL) name/version and system location, and primary contacts. Additionally, the TSI shall provide the methodology for keeping the catalog and ICD/WSDL versions current.

The TFH shall be required to interface with the following external (non-TSI) systems:

1. **The CTRMA DPS:** The TSI shall develop an Application Programming Interface (API) that will allow CTRMA’s DPS system (and perhaps other systems) to interface with the TFH. This API shall be fully documented in an ICD, and CTRMA will review and approve the ICD, and therefore the functionality of the API.
2. **Advanced Traffic Management System (ATMS) Software Interface:** The ETCS/TFH shall interface with CTRMA’s Automated Traffic Center software (Lonestar) based on the Center-to-Center (C2C) ICD, and C2C Toolkit found at the following:
<https://www.txdot.gov/business/resources/engineering-software.html>

The interface will be modified to include the exchange of toll pricing information and other changes as defined during the design phase of the ETCS and agreed to by the TSI and CTRMA. The C2C ICD allows for the sharing of data between the ETCS and ATMS systems, including pricing information from the ETCS to the ATMS.

3. **Data Extract Interface for CTRMA’s Consultants and Auditors:** The TSI shall provide a method (e.g., API or similar) for CTRMA and their consultants to connect to the ETCS and/or TFH data sources for efficient and automated data extracts. The TSI shall coordinate with CTRMA and consultants to determine an acceptable method during the design phase of the ETCS. Currently, this data is downloaded from the SOAP (CTRMA’s FTP Server) Interface using an R-Script. Presently the process involves downloading the data in XML format and converting it into CSV format.

2.6.7 Express Lanes User Interface (ELUI)

The TSI shall provide an application (preferably web-based) to be operated by CTRMA’s Traffic and Incident management staff as well as TSI support staff to monitor and manage all aspects of CTRMA’s express lanes. The ELUI provides a user interface to the DPE.

Table 2-36: ELUI Technical Requirements

ID	RULE
REQ-270	The Express Lanes User Interface (ELUI) shall support applicable business rules in Appendix 10, Lane System Business Rules, and performance requirements, as defined in Appendix 7, Service Level Agreement.
REQ-271	The ELUI shall allow users to review and edit configurations wherever possible for all Express Lane inputs and calculations required for dynamic pricing, rate management, trip building, and all other Express Lane related processes.
REQ-272	The ELUI shall provide a series of interactive dashboards providing information on key express lane operation functions, including an interactive map providing clickable icons of all Express Lane equipment, and dashboards for rate management, historical usage, pricing, and trip building.
REQ-273	All ELUI dashboards, maps, charts, and graphs shall allow users to drill down to detailed data for all aspects of the Express Lane equipment.
REQ-274	The ELUI shall include an interactive map allowing users to select system components and view real-time status for current rates, Microwave Vehicle Detection (MVD) status, level of service, and access to Express Lane CCTVs.
REQ-275	The ELUI interactive map shall allow users to filter (show/hide) any combination of express lane equipment at one time.
REQ-276	The ELUI interactive map shall allow users to select equipment and provide live video feeds within the ELUI application.
REQ-277	The ELUI interactive map shall allow users to view the current Level of Service (LOS) for each MVD selected.
REQ-278	The ELUI interactive map shall allow users to verify status (online/offline) for any Express Lane component.
REQ-279	The ELUI interactive map shall allow users to view all VTMS, including current rates and options for rate override.
REQ-280	The ELUI rate management dashboard shall allow users to review information about current rates and Express Lane and General-Purpose Lane performance, including volume, speed, and LOS.

ID	RULE
REQ-281	The ELUI rate management dashboard shall use a combination of maps showing the performance of Express Lane segments and LOS by segment, speed/volume status gauges, and time-based volume graphs.
REQ-282	The ELUI historical usage dashboards shall provide data on various data points, including a history of throughput, rates, speed, and LOS.
REQ-283	The ELUI pricing dashboard shall allow users to view pricing data for viewing historical pricing and to perform trend analysis.
REQ-284	The ELUI shall provide users the ability to manage all aspects of Express Lane pricing, including, at a minimum, the configuration of input parameters used for pricing algorithms.
REQ-285	The ELUI shall allow users the capability to search and review historical dynamic pricing schedules and details for each period.
REQ-286	The ELUI shall allow users to manage Time of Day (TOD) pricing schedules, including the ability to create, edit, apply, deactivate, and review (current and historical) TOD pricing schedules.
REQ-287	The ELUI shall allow users to define rates and start/end dates and times for TOD pricing schedules.
REQ-288	The ELUI shall allow users to review trip processing data, including current trip building status, and processing data
REQ-289	The ELUI shall allow users to view trip building performance and throughput data, including completed, and pending trip counts, ALPR, and image review stats related to the trip building process.
REQ-290	The ELUI shall allow users to review and edit trip building configurations, including processing time, lapse time, dwell time, ALPR, and auto-match levels.
REQ-291	The ELUI shall allow users to adjust trip fares for one or more trip segments, including partial and full (write-off) adjustments of any amount.

2.6.8 Toll Fare Schedule Management (for Non-Express Lanes Facilities)

The TFH shall provide Toll Fare Schedule Management to set the toll rates for all non-express lanes facilities according to the current CTRMA toll rates.

Toll Fare Schedule Management shall have a simple interface to enable authorized users to add, remove, import, export, and modify the toll fare schedules. Toll fare schedules shall include rates by vehicle classification, payment type, time of day, day of the week, and time of year using a configurable date range.

2.6.9 Servers and Racks

CTRMA anticipates the expansion of their current data platform infrastructure, including servers, network, and storage. The TFH shall support the services of this program, including but not limited to, the following:

1. Design and implementation of the ETCS
2. Transitioning the existing ETCS to the new ETCS
3. Implementing the ETCS on new facilities during the contract term
4. Ongoing maintenance of the ETCS

Table 2-37: Servers and Racks Technical Requirements

ID	RULE
REQ-292	The ETCS solution shall include all proposed or existing cabinets, enclosures, servers, storage systems, workstations, cabling, power distribution units, and any ancillary equipment necessary to provide a complete system that meets the requirements of this RFP.
REQ-293	Any proposed TFH subsystem or component, including servers and all associated hardware elements, shall be of the latest commercially available design and shall incorporate standard commercially available products and components in production at the time of design/development and supported by manufacturers.
REQ-294	The ETCS shall include proven configurations that support future upgrades to system processors, memory components, and storage systems.
REQ-295	The TFH shall be capable of load-balancing all requests and tasks across available processing platforms and share shared Network Attached Storage (NAS) or other storage technologies.
REQ-296	The ETCS shall include a scalable solution that supports the transaction levels indicated in Appendix 15, Traffic Projections.
REQ-297	For system sizing, the ETCS should support the storage of all required transaction data, including 100% of all transactions being image-based, as defined in Appendix 12, Data Retention Schedule.
REQ-298	The ETCS shall scale to support the estimated annual transaction growth (above) with no significant hardware, software, building floor space, HVAC, or infrastructure changes.
REQ-299	All hardware and equipment supplied for this project, excluding consumable materials (i.e., material that needs continuous replenishment), shall support all requirements contained herein, including established SLAs, and shall adhere to specified warranty and service contracts requirements.
REQ-300	All hardware, equipment, devices, supplies, and materials furnished under the contract shall be new, off-the-shelf, and field-proven unless otherwise specified.
REQ-301	The ETCS shall meet American National Standards Institute (ANSI) Telecommunications Industry Association (TIA) data center standard TIA-942.

2.6.9.1 Data Storage

Table 2-38: Data Storage Technical Requirements

ID	RULE
REQ-302	The ETCS shall include an efficient solution for storing and accessing data and files for the TFH at both the primary and the Disaster Recovery sites. The TSI shall follow the Data Retention Guidelines, as defined in Appendix 12, Data Retention Schedule, for all data retained by the TFH.
REQ-303	The ETCS shall maintain and store files for the following: <ol style="list-style-type: none"> 1. Transactional data 2. Lane and TFH configuration and executable data including version numbers, date and time entered in the production system 3. Toll facility toll rates and toll schedules 4. TVL and other data versions, including updates by date and time received 5. Vehicle and license plate image files including toll transaction ID link, location (facility, plaza) code, date, and time 6. Security access authorization data by date and time built 7. System logs from the TFH servers 8. Exempt vehicle lists
REQ-304	The ETCS shall store all toll transaction records, toll lane events, maintenance messages, and work order records, as outlined in Appendix 12, Data Retention Schedule.
REQ-305	The ETCS shall provide authorized users the capability to access the above data through a GUI for display and to generate reports.
REQ-306	The ETCS shall make at least seven (7) years of the above data available online and for display and reporting in the TFH subsystems, and as outlined within Appendix 12, Data Retention Schedule.

2.6.10 Software

The following sections provide information about the software as related to the TFH.

2.6.10.1 *Software Development Plan*

The TSI will provide a Software Development Plan (SDP) describing the TSI’s plans and procedures for their software development effort. The SDP shall detail methods to be used and the approach to be followed for each activity and resource. The SDP should document all processes applicable to software development and reference specific standards, methods, tools, actions, and responsibilities associated with the development of all software required of the ETCS. The SDP should include the following:

1. SDP introduction and overview
2. Referenced documents
3. Identification of all software and software products to which the SDP applies
4. System overview, including system and software architecture
5. Additional requirements and constraints such as security, methods, standards, interdependencies
6. Organization and resources

7. Software development approaches, standards, and methodology
8. Incremental development approach, planning, and management/oversight
9. Software requirements analysis
10. Unit integration and testing
11. Component integration and testing
12. Software risk management
13. Approach to requirements traceability
14. Process for maintaining all software licenses, including third-party COTS

Table 2-39: Software Technical Requirements

ID	RULE
REQ-307	The proposed operating systems and databases shall be currently supported versions with a documented upgrade path from the TSI.
REQ-308	For all COTS-based products implemented in support of the ETCS, licensing and renewals shall be the responsibility of the TSI.

2.6.10.2 *Operating System*

Table 2-40: Operating System Technical Requirements

ID	RULE
REQ-309	Unless the database solution is delivered as a service (SaaS), the operating system for the TFH server(s) shall be COTS multi-user, multi-tasking, and shall be the previous version from current if the latest version/release date is less than twelve (12) months earlier than the Proposal submittal date.
REQ-310	The proposed operating system shall have COTS maintenance support services for the term of the contract.
REQ-311	The proposed operating system shall have an installed base that ranks in the top three for the selected platform supporting an enterprise-class database.

2.6.10.3 *Database Management System*

Table 2-41: Database Management System Technical Requirements

ID	RULE
REQ-312	The TSI Database Management System (DBMS) version/release date shall be the previous version from current if the latest version/release date is less than twelve (12) months earlier than the Proposal submittal date.
REQ-313	The selected DBMS shall have a published upgrade path and support upgrades to the operating system, applications, memory, disk drives, and processors.

2.6.10.4 System Failover and Recovery

Table 2-42: System Failover and Recovery Technical Requirements

ID	RULE
REQ-314	If the TFH is not deployed within the CTRMA-provided facilities (e.g., the CTRMA TIM Center and the CTRMA offices), CTRMA requires the TFH hosting location(s) to adhere to the data center Tier 2 (or higher) power, cooling, redundancy, and security requirements. A Tier 2 (or higher) data center standard must comply with the requirements defined by the Telecommunication Industry Association (TIA) 942.
REQ-315	The location(s) where the TFH(s) are implemented shall be equipped with appropriate power and network connectivity to ensure a successful transition from the primary TFH location to a secondary TFH location. This transition must be accomplished within the required timeframe to support TFH availability and performance SLAs, as described in Appendix 7, Service Level Agreement.
REQ-316	
REQ-317	
REQ-318	
REQ-319	If the TFH is implemented as an active-active solution, the “Failover” procedures shall not take longer than eight (8) hours.
REQ-320	The TSI’s design shall ensure that no data captured/created in the facilities is lost or otherwise compromised when a TFH fails and/or is brought back to full operation.
REQ-321	The TFH locations shall have the appropriate networking infrastructure to support the bandwidth and operational requirements.

2.6.11 Data Backup and Recovery

Table 2-43: Data Backup and Recovery Technical Requirements

ID	RULE
REQ-322	The TSI shall provide an automated capability to back up the TFH daily.
REQ-323	The TSI shall annually demonstrate a successful restoration from backup.
REQ-324	This backup process shall include a scheduled process for both full and incremental backups.
REQ-325	Archived data shall be available to CTRMA within 24 hours of a CTRMA request.
REQ-326	All transactional data (including violation images) shall be retained per the CTRMA data retention policy, and then archived to permanent long-term storage only after the data retention time has expired. Refer to Appendix 12, Data Retention Guidelines.
REQ-327	When online disk space utilization reaches a user-configurable high percent of disk capacity, a message shall be transmitted to MOMS.

ID	RULE
REQ-328	The deletion of data that has reached its configured expiration timeframe or has been successfully archived shall be automatic without the need for user intervention. It shall generate a message transmitted to MOMS.

2.7 PROJECT MANAGEMENT

The following sections provide information about system development and project management Scope of Work.

2.7.1 Project Schedule

The TSI shall prepare and submit a detailed project schedule based on a work breakdown structure that includes all tasks, activities, and milestones related to the requirements gathering, design, development, procurement, installation, testing, training, and deployment of the proposed system. The schedule shall contain all the detailed discrete work packages and planning packages (or lower-level tasks/activities) networked with necessary dependencies to support project events. The TSI shall maintain the project schedule in Microsoft Project format (Microsoft Office 2016 or newer). The TSI shall identify all milestones and events, starting with the Notice to Proceed (NTP), to the end of the implementation phase, culminating with the final Operational Acceptance Test (OAT).

The TSI’s Proposal shall include a preliminary event-driven project schedule. The schedule shall be updated, and resource loaded following NTP to baseline the schedule by including unknowns and any changes during negotiation. All subsequent schedule updates shall be made to the revised baseline for the duration of the project. The TSI shall submit the project schedule per Appendix 13, Project Deliverable Schedule. The TSI shall update and make the project schedule available to CTRMA every month. The TSI shall also submit an updated version of the project schedule as part of the monthly progress report, described in Section 2.7.2, Regular Project Meetings.

The project schedule shall include activity start dates and durations, milestones dates, predecessor and successor dependencies, resources by name, and a critical path representing activities without any slack. The project schedule shall provide for the CTRMA documentation/deliverable review cycles that include the following:

1. The initial TSI submission of the documentation
2. CTRMA’s review and comment on the documentation
3. The TSI’s update of the documentation per CTRMA’s review comments
4. The subsequent second CTRMA review and comment on the documentation, if needed

A project schedule of documentation deliverables shall include a spreadsheet updated weekly for submittals in a two-week look ahead, and in real-time for submittals sent to CTRMA or received from CTRMA. The project schedule shall reflect each document submittal in whole and sections as agreed upon for CTRMA review.

At least monthly, the project schedule shall be submitted to CTRMA in Microsoft Project format with a PDF file and associated narrative with the following updates:

1. The project schedule shall provide the completion status of all tasks, activities, and milestones (e.g., deliverable submittal, project review meeting).
2. The project schedule shall provide all task activities resource loaded by name, and resource reports generated to demonstrate staff is not over-allocated across all tasks.
3. The project schedule shall identify tasks, activities, or milestones that are behind schedule. For example, if the preparation of a deliverable has expended 60% of the scheduled completion time while the completion percentage is only at 50%, then this deliverable is behind schedule. If a recovery schedule cannot prevent a project completion delay, the TSI shall provide a risk matrix/register with a mitigation strategy for critical path tasks and activities. Near-critical path analysis shall be accomplished as well.
4. The TSI shall provide version control with project schedule updates.

All scheduled tasks for the project schedule shall include at a minimum:

1. WBS number
2. WBS name
3. Resources performing the task activity
4. Subsystem affected
5. Task duration (includes start to finish of activities to complete a task)
6. Planned versus actual time at the start of the task
7. Predecessors and successors

2.7.2 Regular Project Meetings

Monthly project progress meetings shall be held at a location agreed and approved by CTRMA and shall follow a defined agenda. The TSI shall submit a progress report and a meeting agenda to CTRMA at least two (2) business days before the scheduled meeting.

Prior to any CTRMA system/network changes, which is defined as needed software updates to the system(s) or communication network updates, the TSI shall obtain CTRMA's review and approval. Changes to the system/network presented within the monthly project progress meetings without having first gone through the processes defined in the TSI's Change Management Plan (described in Table 2-44: Program-Level Document) shall not be approved.

The progress report and agenda shall include but not be limited to the following:

1. Updated project schedule showing progress since the previous meeting and including any proposed changes from the latest approved project schedule.
2. Completed work descriptions and the percentage complete for each task in progress.
3. Identification of all critical path tasks.
4. Risk/issue matrix changes, including associated recommended mitigation/resolution strategies or contingency plans intended to avoid potential delays.
5. Report on testing activities, including status and overview of defect tracking results (when applicable).

6. Descriptions of any pending and proposed change orders, or if any change order work is in progress, the status of the associated work.
7. Accomplishments during the reporting period.
8. Six (6) week look ahead work plan for activities to be accomplished on the project.
9. Updated action items list providing the status of the open action items, identifying and explaining action items that can be closed, and documenting new action items resulting from the discussion of outstanding issues and concerns. The action items list shall contain both the open action items assigned to CTRMA and the open action items assigned to the TSI.
10. Copy of the approved final minutes of the previous meeting.

Other project meetings shall be required to address specific issues and tasks. The TSI shall perform the following:

1. Coordinate date and time with the CTRMA Project Manager and distribute notices of the project meeting by email and post them on the approved project document management, sharing, and distribution cloud application.
2. Prepare the agenda in coordination with the CTRMA Project Manager.
3. Attend the meeting with all required staff in attendance or present by teleconference.
4. Prepare draft minutes of the meeting, with decisions and action items noted, and forward them to the CTRMA Project Manager immediately following (the day of) the meeting.

2.7.2.1 Project Kick-off and Work Progress

A project kick-off meeting shall be held between CTRMA and the TSI within thirty (30) days of the project NTP. At this meeting, all appropriate lines of communication for both oral and written correspondence shall be established. Appropriate methods for documenting meetings, telephone conversations, and other communications shall be defined. The project schedule shall be reviewed in detail and refined, as necessary.

The TSI shall prepare and submit to CTRMA monthly progress reports on the status of all-major items and activities. The progress report shall include an updated project schedule.

Project progress meetings shall be conducted monthly at the CTRMA offices, at a schedule to be proposed by the TSI and accepted by CTRMA. The purpose of these meetings shall be to monitor progress, discuss design issues, and plan for installation, testing, and transition.

The TSI shall allow CTRMA to conduct periodic inspections of the software development effort, including reviewing the status of source code. These periodic inspections include an on-site review at the TSI's development facility. The inspections may include an actual review of files with the TSI present, reviewing file size, the number of lines, work completed, and witnessing unscripted and unofficial testing of incremental development versions of the software. These periodic inspections could occur monthly or at some other frequency to be defined by CTRMA.

2.7.2.2 Workshops

The TSI shall conduct monthly workshops with appropriate stakeholders to review all submissions, validate system requirements, design approach and design, report formats, and other issues requiring coordination between CTRMA and the TSI. Whenever possible, these workshops should be scheduled in conjunction with project progress meetings. With CTRMA's approval, some workshops may be conducted via conference call.

2.7.3 Program-Level and Project-Level Documentation

The services solicited by this RFP include not only the transition to a new ETCS but also a phased implementation of this new ETCS to new facilities as they rollout. Because of the nature of this program, CTRMA requests the following two segments of documents:

- Program-Level Documentation, which includes a Program Management Plan (PMP), and
- Project-Level Documentation

The PMP shall consist of several program-level documents to be provided only once during the entire program and updated as needed. CTRMA anticipates minimal changes required throughout the program to these core documents. However, the TSI shall provide updates to the program-level documentation for each Work Authorization when required.

The TSI shall submit updated or amended program-level documentation with each Work Authorization to reflect changes required for each transitioned or newly installed facility, along with the required project-level documentation.

Project level documentation unique to each facility (e.g., as-builts, test reports, transition/install plans) shall be provided for each Work Authorization.

The program-level documentation is detailed in Table 2-44: Program-Level Documentation. The project-level documentation is detailed in Table 2-45: Project-Level Document.

2.7.3.1 Plans and Requirements

All plans and documentation shall be submitted in the English language to CTRMA electronically through a secured document management system. Refer to Section 2.7.6.5, Online Document Sharing and Document Management System, for more information.

All plans and documentation shall be submitted to CTRMA for review and acceptance. Plans and other documentation shall be submitted to allow time for a minimum of two iterations of the CTRMA review/TSI revisions to be completed and still adhere to the targeted final document deliveries identified by the TSI and approved by CTRMA. Any need for resubmittal shall not be a cause for delay in completing the project following overall project milestones. Acceptance of documents shall not relieve or limit the TSI's responsibility to provide an ETCS in full compliance with the contract. If corrections or improvements are requested, the TSI shall resubmit the plans and documentation until the plans and documentation are fully accepted.

In addition, CTRMA has the right to reject and request resubmittal of any documentation that contains quality issues (i.e., multiple errors related to spelling, grammar, and formatting).

Deviations from the RFP requirements that may be contained within TSI submitted documents, even though CTRMA may accept the document, shall not have the effect of modifying contract requirements. Only specific requests to CTRMA from the TSI for waivers or specification changes that are formally accepted by CTRMA will change requirements in the contract.

Appendix 13, Project Deliverable Schedule, lists the deliverables that the TSI is required to prepare and submit during the project, including the required submission date and duration of review periods by CTRMA.

2.7.3.1.1 Program Management Plan

A Program Management Plan (PMP) shall be submitted to CTRMA, which shall reflect that the TSI follows the processes and tools consistent with the most recent and applicable Project Management Institute’s (PMI) Project Management Body of Knowledge (PMBOK). The PMP shall include a description of the management techniques to be used during all phases of the project.

The TSI shall develop and submit to CTRMA for review and approval of a PMP describing the overall management, staffing, and measurable controls used to meet the requirements contained herein. The TSI shall submit the PMP in the initial documentation package per Appendix 13, Project Deliverable Schedule.

Since this program shall be rolled out over time for existing facilities and new construction, the PMP shall address several projects that could have different timelines and teams. The following documents provide scope information for the initial project and subsequent Work Authorizations (covered under this contract) and shall not need to be resubmitted with each project.

These documents that make up the PMP include, at a minimum, the documents listed in Table 2-44: Program-Level Documentation. For a full list of required documents, refer to Appendix 13, Project Deliverables Schedule.

Table 2-44: Program-Level Documentation

Document	Description
Master Project Schedule	Provides the initially projected activity dates used as a baseline for comparing the actual, achieved dates, and measuring progress.
Roles and Responsibilities	Provides information about the responsibilities of each role for the project team for the program and includes an Organizational Chart. Refer to Section 2.7.6.3, Staffing and Organizational Chart, for more information.
Scope Management Plan	Provides the tasks required to complete the project while excluding all the work/tasks that are out of scope.
Quality Management Plan	Provides information about the processes and procedures that ensure the QA/QC program functions as an integral part of the project. Refer to Section 2.7.5, Quality Assurance/Control Program for more information.

Document	Description
Communication Management Plan	Provides information that details the communications needs and expectations for the entire program.
Requirements Management Plan	Provides information about the defining, documenting, analyzing, prioritizing, and managing of the requirements of the project.
Change Management Plan	Provides information about the activities and roles to manage and control change during the execution and control stage of the project.
Configuration Management Plan	Provides information about defining, documenting, controlling, implementing, accounting, and auditing of changes to the various components of this project. Refer to Section 2.7.5.2, Configuration Management, for more information.
Risk Management Plan	Provides information about the methods to identify, track, and mitigate areas of risk, including cost. Refer to Section 2.7.7, Risk Management, for more information.

This PMP shall be a living document, and as such, shall be updated periodically to reflect any changes to the program, and submitted to CTRMA for review and approval. The TSI shall maintain and keep current all incorporated individual plans, procedures, and processes that comprise the PMP for the duration of the contract.

2.7.3.1.2 Project-Level Documentation

The Project-Level documentation that a TSI shall provide or update per Work Authorization includes, at a minimum, the documents listed in Table 2-45: Project-Level Documentation. For a full list of required documents, refer to Appendix 13, Project Deliverables Schedule.

Table 2-45: Project-Level Documentation

Document	Description
Project Scope	Provides information about the specific project, including any deliverables and their features, major project objectives, deliverables, and goals to help measure success.
Baseline Cost	Provides information about the amount of money the project is predicted to cost and when that money shall be used.
Project Schedule	Provides a simplified list of tasks with a timeline or project calendar, including major milestones and key deliverables. Refer to Section 2.7.1, Project Schedule for more information.
Updated Roles and Responsibilities (if required)	Provides information about the responsibilities of each role for the team for each Work Authorization and includes an Organizational Chart. Refer to Section 2.7.6.3, Staffing and Organizational Chart, for more information.

Document	Description
Project Risk Register	Identifies each risk and the mitigation strategies for each risk per project.
Communication Plan	This document provides information about how the TSI shall communicate information to stakeholders. This plan describes who should be given specific information, when that information should be delivered, and what communication channels shall be used to deliver the information.

2.7.3.2 Design and Development Demonstrations

CTRMA requires that the TSI provide systems/application demonstrations during the design and development phases of the project. These demonstrations will require the TSI staff to include system architects, designers, business analysts, and subject matter experts. The CTRMA staff and the CTRMA representatives will participate in these demonstrations. These demonstration sessions/meetings shall demonstrate to CTRMA the design and development of the system are ongoing, on track according to schedule, and shall meet the functional requirements of the system.

These demonstrations shall be identified in the master project schedule, and the timing and frequency of them shall be agreed upon between the TSI and CTRMA.

The TSI shall propose a weekly report format that, at a minimum, communicates the system component under design consideration, development, demonstrated, or tested during a period of the report (weekly and/or monthly). This report shall also communicate test cases exercised. This report shall be provided to CTRMA starting at the beginning of the design phase and shall be called out in the master project schedule. These reviews and demonstrations will all be conducted during the design, development, and even testing phase of the project, and all shall be concluded before the commencement of OAT.

Design and development reviews and demonstrations may be observed by CTRMA on-site at the TSI’s development location, via web-based demonstrations and conference calls, or at the CTRMA offices in Austin. The exact location of each development review and demonstration shall be determined and communicated to CTRMA no less than three (3) weeks before each review and demonstration. These sessions shall be conducted within the continental United States.

2.7.4 Report Development Workshops

The TSI shall facilitate report development workshops with CTRMA during the design phase using the following reports development methodology:

1. The TSI shall gather fundamental reporting requirements by answering these questions:
 - a. What is the purpose of the report?
 - b. How will the report be used?
 - c. Who will use the report?
 - d. Who are the secondary consumers of the report?

- e. Report frequency?
 - f. Report parameters and filters?
 - g. Data sources?
 - h. To which other reports shall this report tie?
 - i. Summary, detailed level, or both?
 - j. Basic layout?
2. The TSI shall provide a proof of concept/mock-up for approval by CTRMA, including a report data element dictionary, which shows the source or calculations for each data element, and an explanation of how the report should compare or match with other reports. The TSI shall gather feedback and requirements refinements and update the mock-ups.
 3. Final review with CTRMA for minor changes only.

In addition to the TSI's standard suite of reports, the TSI shall be responsible for designing, developing, testing, and implementing up to fifteen (15) custom reports. These custom reports shall be based on CTRMA's requirements. During the design phases of the project, if CTRMA is unable to provide the requirements for all fifteen custom reports, the TSI shall still be responsible for the design, development, testing, and implementation of all remaining custom reports.

Additionally, six (6) months after system acceptance, the TSI shall support significant updates to up to ten (10) existing standard reports. These report changes (for custom or standard reports) shall be provided to CTRMA at no additional cost.

2.7.5 Quality Assurance/Control Program

The TSI shall establish, maintain, and follow an effective Quality Assurance/Quality Control Program (QA/QC Program) to ensure adequate conformance to requirements and quality delivery of all project deliverables and tasks. This conformance to requirements includes the design, development, fabrication, processing, assembly, inspection, test, training, maintenance, packaging, shipping, storage, site preparation, and installation.

The QA/QC Program shall be overseen by a QA/QC Manager who reports at an organizational level above the TSI's Project Manager, or outside of the Project Manager's direct staff.

The TSI shall document the QA/QC program as part of a Quality Management Plan (QMP). The QMP shall describe the processes and procedures instituted by the TSI to ensure the QA/QC program functions as an integral part of the project.

All supplies, equipment, devices, hardware, software, and other services delivered as part of the contract, whether manufactured or performed within the TSI's plant or at any other source, shall be controlled at all points necessary to ensure conformance to the contract specifications. The QA/QC Program shall focus on the prevention, early detection, and correction of discrepancies.

TSI's QA/QC program shall provide control and tracking of purchased materials and subcontracted work. The TSI shall ensure the conformance of all supplies, components,

developmental tools, assemblies, subassemblies, and services procured from subcontractors and vendors to the requirements contained herein. The TSI shall also establish procedures for the selection of qualified, reputable, and financially secure suppliers and subcontractors and take responsibility for controlling the quality of the supplies and services provided.

The QA/QC Program shall include a process for logging and tracking system issues. This process shall include the initial recording of issues, follow-up tracking, and final disposition tracking during the design, development, testing, and implementation phases of the project. The QA/QC process shall ensure accurate problem or issue description and recording, assignment of personnel, tracking of progress for corrections/revisions, and regression testing, as applicable. The TSI shall use a fully integrated problem or issue tracking tool that includes reporting capability.

2.7.5.1 Change Control

The TSI shall propose an internal change control process as part of their QMP. Once approved by CTRMA, the change control process shall be instituted and utilized throughout the life of the project.

2.7.5.2 Configuration Management

The TSI shall use proven configuration management tools and techniques throughout the project to track and control versions of hardware, Commercial Off-The-Shelf (COTS) software products, and customized software. The TSI shall control their documentation through a configuration management system that tracks changes to documents and controls configuration release and version numbering. This plan shall include the methodology for keeping all products current and the planning and upgrade testing needed to accomplish this.

On an annual basis, the TSI shall ensure that all COTS software remains supported by its original manufacturer. The TSI shall also update system software and hardware to support any changes in third-party interface communications (through ICDs) and industry standards. If a COTS vendor announces the end of support for any installed COTS software products, the TSI shall make the necessary changes to support a replacement COTS product for at least the duration of the contract. If licensing requires renewal or action by CTRMA, the TSI shall make this request from CTRMA at least sixty (60) days before the expiration date of the license or product. If there are modifications to industry standards that warrant addressing to maintain required security, communication, safety, and performance, the TSI shall immediately notify CTRMA and shall propose an update or replacement equal or better to the current COTS product or custom software. This replacement plan shall include a schedule, proposed testing for approval before migration to the new product.

Once the TSI places any portion of the proposed system into operational service, the TSI shall not change or replace any production hardware or software without written approval from CTRMA. The TSI shall document any such approved changes as part of the configuration management process. The TSI shall provide and maintain specific change and release management plans reflecting the methodologies for the approval and release of any subsystem changes, including simple configuration changes or hard code changes.

The TSI shall obtain CTRMA's review and approval prior to any needed updates to the system(s) or communication network updates.

The Configuration Management Plan shall address the following areas:

1. Configuration Control:
 - a. Requirements management
 - b. Deviation and specification change requests
 - c. Data management
 - d. Configuration audits: functional and physical
 - e. Acceptance requirements for the installed ETCS
 - f. Testing requirements for the installed ETCS
2. Configuration Accounting:
 - a. Document Control and the Library Function
 - b. Accepted Documents
 - c. Revision History for Documents
 - d. Physical Item Content
 - e. Physical Item Where Used
 - f. Status of Changes
 - g. Changes by Product/Serial Number
 - h. Results of Configuration Audits
 - i. Configuration Management Accounting (As Designed, As-Built, As Delivered)
 - j. Revision Status of Installed ETCS
 - k. Version control

The Configuration Management Plan shall describe procedures to track and manage COTS and custom application software, hardware, configuration files, and project documentation following EIA-649-A 2004 National Consensus Standard for Configuration Management and 828-2012 IEEE Standard for Configuration Management in Systems and Software Engineering. The Configuration Management Plan shall include the manufacturer, version number, feature set, and the number of user licenses used of all COTS products, the methodology for keeping all products current, any testing required for an upgrade, and addressing implications and reconciliation of vendor support termination. CTRMA anticipates twenty (20) concurrent end-users of the system.

In addition to procedures to assure uniformity of installed software version and release for the project duration, the plan shall include the maintenance of an end of project checklist verifying all installed COTS and custom products are the current version and release. All COTS hardware shall provide information about the manufacturer, vendor contact information, model or part number, serial number, and feature set.

The TSI shall submit the Configuration Management Plan to CTRMA for review and approval.

The TSI's shall identify, categorize, code/label/name, track, and manage all project requirements, plans, design documentation, manuals, drawings, correspondence,

memorandums, subcontracts, and other documents under the TSI's control. The TSI shall document and track all revisions using a system of version control and change control logs.

All documentation developed by the TSI for the project, including materials developed to support training and marketing, shall be the property of CTRMA.

2.7.5.3 Continual Improvement Program

The TSI shall participate in a Continual Improvement Program (CIP) with CTRMA. The CIP intends to realize improvements in system and operations that shall benefit CTRMA and CTRMA customers. Benefits for CTRMA and CTRMA customers include the following, at a minimum:

1. Increasing revenue
2. Decreasing operating costs
3. Improving the customer experience
4. Improving data management, reporting, and audibility
5. Enhancing the efficiency and safety of the ETCS and the ETCS operations

Beginning with approval of the OAT, and annually after that, the TSI shall meet with CTRMA to identify elements of the ETCS and the TSI's operations to improve. The specific schedule for the CIP shall be determined after the contract award, but the TSI should assume that the first CIP meeting shall be held with CTRMA within one (1) year after system acceptance.

Within four (4) weeks of each meeting, the TSI shall provide CTRMA with a written proposal including the following elements:

1. A description of the element(s) of the ETCS and the TSI's operations identified for improvement. The description shall include how the TSI shall achieve the improvement(s), including all work necessary, changes to the ETCS, software, or equipment, and any required coordination or involvement from CTRMA.
2. A specific improvement goal(s), which indicates both the current performance level for the element(s) and the proposed improved performance level.
3. How the performance of the element(s) shall be tracked and measured. When applicable, improvements shall be driven by measurable performance characteristics. Results shall be measured to document performance improvements. All measured performance characteristics shall be based on objective criteria. The TSI shall clearly describe how CTRMA shall be able to review and validate the performance of the element(s).
4. A detailed description of benefits to CTRMA and CTRMA customers that would result from the improvement(s). If possible, the description of benefits shall include a financial analysis of how the proposed improvement(s) would result in the following:
 - a. Higher revenue
 - b. Lower operating costs
 - c. Improved customer service
 - d. Data management
 - e. Reporting

- f. Audibility
 - g. Enhancement of the efficiency and safety of the ETCS and the ETCS operations
5. A detailed precedent oriented schedule presenting the activities required to realize the proposed improvement, including the time frame over which the improvement shall be measured and the date by which the improvement goal shall be reached.
 6. A description of how the TSI shall maintain the improved element(s) at a higher performance level.
 7. A detailed cost estimate to implement the improvement. The cost shall include the TSI's labor, materials, and other costs.

CTRMA shall have four (4) weeks to review the TSI's Proposal and approve, reject, or ask for modifications. If CTRMA requests modifications, the TSI shall provide a revised Proposal to the TSI within four (4) weeks. CTRMA may choose not to implement an improvement at any time before accepting a Proposal and instructing the TSI to proceed with an improvement(s). CTRMA may postpone CIP meetings or suspend the CIP program at any time at its sole discretion.

2.7.6 Program Management

The following sections provide information regarding the TSI's approach to program management.

2.7.6.1 Project Methodology

The TSI shall demonstrate a thorough understanding of the project phases and key knowledge areas for project management identified by the PMI. The PMP shall explain how the TSI use of PMI techniques will lead to successful project implementation. The PMP shall address how the TSI shall manage the following elements:

1. Project communication
2. Primary project responsibility
3. A risk register that identifies all risks and details how the risks shall be managed and mitigated
4. Subcontractor management and coordination
5. Progress scheduling (Critical Path Method [CPM] based)
6. Progress reporting and coordination with CTRMA
7. Testing
8. Design and development reviews
9. On-site installation
10. Record keeping, including generating all meeting agendas and minutes

Refer to Section 2.7.3.1.1, Program Management Plan , for information regarding the PMP.

2.7.6.2 Responsibilities Matrix

The Responsibilities Matrix shall document the roles and responsibilities of all parties involved with the design, construction, installation, testing, commissioning, and maintenance of the ETCS being procured under this RFP. Approval of the Responsibility Matrix by CTRMA is a

precondition to payment of the mobilization milestone, and it is acceptable for the TSI to submit this matrix before the PMP if desired.

The primary parties involved with this project include, but are not limited to, CTRMA and the TSI and its subcontractors and vendors. The TSI shall identify and include all other primary parties involved with its work.

All work shall be broken down to element, task, and component within the subsystems, with responsibility assigned to one of the parties as taking a lead role. Any support and/or coordination activities shall also be identified and assigned.

2.7.6.3 Staffing and Organizational Chart

The TSI shall include an organization chart and resumes per Appendix 5, Technical Response Guide, listing the key project personnel along with their roles and responsibilities, and the percentage of time they shall dedicate to the project.

Table 2-46 provides information about the TSI’s key personnel for the project.

Table 2-46: TSI’s Key Personnel for Project

Key Position	Description
Principal-In-Charge	<p>The Principal-In-Charge should have been an employee of the TSI for a consecutive six (6) months. This position shall have a minimum of ten (10) years of experience in the toll/revenue collection industry, with at least the last five (5) years shall have included senior management responsibility for major projects of which at least one (1) project shall have been five (5) million dollars or more in value.</p> <p>The Principal-In-Charge is responsible for the performance of the Program Manager and a point of contact for any escalated project issues that cannot be resolved by the Program Manager.</p>
Program Manager	<p>The Program Manager shall have been an employee of the TSI for a consecutive six (6) months and shall have a minimum of ten (10) years of experience in the toll/revenue collection industry, of which at least the last five (5) years shall have included senior management responsibility for major projects of which at least one (1) project shall have been five (5) million dollars or more in value. Certification as a Project Management Professional by the Project Management Institute is preferred, but not required.</p> <p>The Program Manager is responsible for the overall conduct and performance of the project, oversight of the project and is primarily responsible for the day-to-day execution of the work. The Program Manager is responsible for the execution of the work, acts as an agent, a single point of contact in all matters on behalf of the TSI, and must be present (or an approved designee shall be present) at the project site at all times when the work is being performed. The Program Manager must be available to execute instructions and directions received from CTRMA or its authorized representatives.</p>

Key Position	Description
	<p>The Program Manager shall be a locally dedicated resource.</p>
Deputy Program Manager	<p>The Deputy Program Manager serves as a backup to the Program Manager and must support the Program Manager in the day-to-day execution of their duties and delivery of the work.</p> <p>This backup position can be provided by existing key personnel (e.g., the Maintenance Manager could also serve as the Deputy Program Manager). However, the Deputy Program Manager role is the only key personnel position that can be held by the same individual as another key personnel position. Note: The Program Manager cannot also serve dual roles as the Deputy Program Manager.</p>
Installation Manager	<p>The Installation Manager shall have a minimum of five (5) years of experience, within the last seven (7) years, managing the construction coordination and field installation of toll systems, for both traditional toll roads and dynamically priced managed lanes of at least the size and scope of this contract.</p> <p>The Installation Manager is responsible for the installation of the entire toll system at the project site from planning to acceptance, and always following all relevant safety guidelines during the installation. This responsibility includes design and construction coordination before the project site becomes available and throughout the installation.</p>
Maintenance Manager	<p>The Maintenance Manager shall have a minimum of five (5) years of experience within the last seven (7) years, maintaining toll systems for AET (including dynamically priced managed lanes) of at least the size and scope of this contract.</p> <p>The Maintenance Manager is responsible for the ongoing maintenance of the system to meet functional and performance requirements.</p> <p>The Maintenance Manager shall be a locally dedicated resource.</p>

Key Position	Description
Quality Manager	<p>The Quality Manager shall have a minimum of five (5) years of experience within the last seven (7) years, implementing best practices for quality control and quality assurance.</p> <p>The Quality Manager must provide quality oversight on all aspects of the work and all deliverables to CTRMA, to ensure compliance with the Quality Management Plan (QMP). The Quality Manager must also provide the following, at a minimum:</p> <ol style="list-style-type: none"> 1. Provide oversight of the quality of the work and detailed review process for the system design 2. Not be involved with direct scheduling or production activities 3. Report directly to the TSI’s management team 4. Ensure the TSI’s design staff follows the implementation of the methods and procedures contained in the approved QMP 5. Provide document control verification report and coordinate all issues directly with the TSI’s Program Manager and CTRMA’s designated representative

The TSI shall provide detailed resumes for each key personnel resource. The TSI shall submit any changes to these key personnel to CTRMA in writing for approval for the duration of the contract. CTRMA shall require the TSI to promptly replace the said individual with a person suitably qualified, within thirty (30) days of the event requiring replacement and acceptable to CTRMA. Additionally, the TSI shall perform background checks of all key staff.

The TSI shall clearly describe categories of work performed by the TSI’s personnel and those categories that shall be performed by subcontractors, who shall be named in the Proposal and included in the Organizational Chart. The TSI PMP shall include a description of the procedures used for managing all subcontractors, specifically how the TSI shall address communications and how to escalate any issues that may arise. Any TSI modifications from the Proposal that includes key personnel or responsibilities to be shifted from TSI to a subcontractor and vice versa shall be requested in writing for approval by CTRMA. The TSI shall communicate the details of these key personnel changes or responsibilities through updates to the project schedule and the PMP, specifically the Organizational Chart, the Roles and Responsibilities, and a resume of the new key personnel.

The TSI shall submit these updates to CTRMA for approval no fewer than sixty (60) days of the actual transition of responsibilities.

Before the implementation of the change in responsibilities, CTRMA shall provide approval in writing upon acceptance of the staff changes portions of the PMP.

2.7.6.4 TSI Personnel Security

All TSI personnel shall be subject to security and background checks to the satisfaction of CTRMA. The TSI shall obtain written approval from CTRMA for all service personnel.

The TSI’s personnel shall be issued CTRMA identification badges and shall always wear such identification badges when performing duties on the project. The CTRMA identification badges

cannot be shared among different TSI personnel. The TSI personnel shall only use the CTRMA identification badges they are assigned.

Misuse of the CTRMA identification badges (e.g., using one badge for multiple TSI personnel, or using the identification badges for purposes other than work associated with the project) may result in termination of the employee from the project and possibly other legal or disciplinary action.

The TSI shall not use the CTRMA facilities as a co-location for its staff and their vehicles. However, TIM Center operators are the exception.

2.7.6.5 Online Document Sharing and Document Management System

The TSI shall use a secure, online project management/collaboration software of their choice to internally manage, share, and distribute project documents and information (e.g., SharePoint, Dropbox, Sync.com), including copies of all submitted versions of plans and documentation. CTRMA will also provide a document management system for the TSI to submit all documentation and deliverables into that system. Any documentation that is stored in the TSI document management system shall also be copied to the CTRMA document management system.

The TSI shall provide and maintain for the duration of the contract, a secure document management system. This document management system shall identify, categorize, track and manage all project plans, manuals, business rules, and requirements, design documentation, test cases, training materials, as-built documentation, and other project documents defined under Appendix 13, Project Deliverables Schedule. All documentation and artifacts contained in the document management system shall be easily searchable and accessible by authorized users of both CTRMA (and others designated by CTRMA) and the TSI. The TSI shall provide the required licensing of the product for each user accessing the system. Updated versions of project documents shall be submitted to CTRMA for approval whenever significant revisions are made to project documentation. All documentation developed by the TSI for the project, including materials developed to support training and marketing, shall be the property of CTRMA.

The TSI shall provide a Documentation Lead for the duration of the contract to ensure all documentation revisions are documented and tracked using a system of version control and change control logs. The Documentation Lead shall also ensure all documentation is successfully updated when changes in requirements, change orders, Work Authorizations, or upgrades or changes in software or equipment occur. The Documentation Lead shall ensure all documentation, particularly those related to design (e.g., ICDs, RTM, SDDD), training, user manuals, or procedural items (e.g., maintenance and disaster recovery), is maintained and remains current, incorporating any system changes or new projects coming online, for the duration of the contract. The TSI shall provide training to the CTRMA staff for accessing documents in the document management system, if necessary.

All documentation shall be submitted to CTRMA for review, comment, and approval. CTRMA may require updated versions of draft documentation before providing approval. Draft and

final versions of documentation shall be delivered electronically to CTRMA using online document sharing. The TSI shall deliver documents in a standard Microsoft Office application format, which allows for red-lining and tracking changes. All documents are subject to version control; once submitted to CTRMA, the TSI shall submit all future revisions of a document in both red-lined and clean versions.

2.7.6.6 Records Keeping

The TSI shall maintain quality records and data such as records of design reviews and code walkthroughs, inspections and test results, records pertaining to nonconforming material, change order documentation, audit results, and all other records related to the RFP and resulting contract for no less than five (5) years after the expiration of the contract. This information shall be made available to CTRMA at any time upon request.

2.7.7 Risk Management

The PMP shall describe the risk management method the TSI shall implement to identify, track, and mitigate areas of project risk, including cost. The TSI shall track concerns throughout the project, such as the occurrence of certain events with assigned and described risk probability, impact, and mitigation (e.g., elimination, contingency, and reduction). Special risk planning sessions shall be initiated by the TSI at least five (5) months before go-live activities are planned for the TFH and each facility, as they are transitioned. These risk planning sessions shall include the following deliverables:

1. Identify all high-risk events which could occur as part of the deployment in terms of transitioning co-located equipment and devices and transaction processing, and historical data retrieval and reporting.
2. Produce queries that seek to identify any occurrence of the high-risk items identified in the item.
3. At pre-defined intervals, review reports and queries for validity, and notify the responsible TSI resources for immediate issue assessment if the results are invalid. The CTRMA-assigned distribution list shall receive status reports of the results generated and sent daily, during a defined time (e.g., four [4] weeks) immediately after go-live.

2.7.9 Cooperation with Others

CTRMA shall be entitled to full and prompt cooperation of the TSI in all aspects of the work. The TSI shall use best efforts to minimize any disruption to CTRMA's regular business operations (including am and pm peak hours as applicable) when the TSI is performing services. Close coordination between the TSI, the CTRMA operations staff, and other contractors shall exist during all phases of the project. The TSI shall work closely with any other contractors working for CTRMA in coordinating any activity which may affect both the contractors and CTRMA. This coordination especially pertains to CTRMA's DPS connectivity and integration testing, contractors performing equipment installation, equipment testing, power requirements, conduit requirements, and researching networking issues, which may involve multiple contractors.

The TSI shall also cooperate with other parties, including vendors, governmental agencies, and other maintenance providers, as required, to ensure that maintenance functions are handled effectively, efficiently, and per all specifications of any applicable vendors, governmental agencies, and other maintenance providers.

The TSI shall respond to the CTRMA requests for information within two (2) business days unless otherwise agreed to by CTRMA.

2.8 INSTALLATION OF NEW FACILITIES

The TSI shall be responsible for the installation of the TSI's ETCS for new facilities as they are constructed and made ready for toll equipment installation and ETCS testing and operations. The TSI shall be required to coordinate efforts and schedules and shall provide CTRMA with an Installation Plan for all new facilities.

The TSI shall begin installation work upon approval of individual Work Authorizations for each facility, as described in Section 2.2.1, Work Authorization and Project Delivery.

General information for the planned facilities is found in Section 2.3, Existing Equipment, Infrastructure, Buildings, and Communication. Additional information may be found on each project's website:

1. 183 North: <http://www.290Tollorth.com/>
2. MoPac South: <http://www.mopacsouth.com/>
3. 183A Phase III: <https://183a.com/>

Note: Project schedules and plans for all planned facilities continue to be developed and are subject to change.

The TSI shall install all proposed hardware, equipment, software, and devices required to implement, integrate, and maintain an ETCS that meets all the requirements described herein. To install the roadside systems, the TSI shall supply all required installation personnel, tools, materials, equipment, and traffic control devices.

The TSI shall install all components manufactured/provided by any third parties per the manufacturer's installation instructions. The TSI shall arrange on-site and remote support services, as needed, from a third-party vendor for proper installation and operation of equipment at no additional cost to CTRMA.

The TSI shall procure and install any additional infrastructure required to operate and maintain the ETCS. This additional infrastructure may include, but is not limited to, additional electrical and communication conduit, ducting, pull boxes, junction boxes, wires, cables, connectors, terminals, and termination labels. The TSI shall coordinate with CTRMA to provision the required network equipment, bandwidth, and connectivity to the newly established toll facilities in support of the ETCS.

The TSI shall install and configure the proposed ETCS software and any supporting software (e.g., operating system, networking, database, monitoring) on all proposed computers, workstations, and servers. The TSI shall coordinate all work with the CTRMA operations staff.

The TSI and CTRMA shall then determine if the work needs to occur after hours or on the weekends to minimize impacts on existing operations. All TSI-provided systems shall provide compatibility to run on the CTRMA-provided workstations, and the CTRMA designated representative-provided workstations.

2.8.1 Installation Plan

The TSI shall submit an Installation Plan to CTRMA for review, comment, and approval before the start of any installation activities. The Installation Plan shall provide a comprehensive description of all aspects of the installation activities associated with the project, including the following:

1. Installation approach, including timing for the installation and integration of all systems,
2. Installation readiness assessment, including a risk matrix that identifies risks, assesses the probability of those risks occurring, and proposes mitigation or elimination strategies. Reasonable scenarios of problems should be presented, and proposed actions are taken to allow installation to continue.
3. Facilities operations.
4. Toll Facility Host integration, which includes image processing, trip building and dynamic pricing functionality (if applicable), report validation, DPS integration, TSI QA/QC processes and procedures, and support for any auditing process.
5. Predecessor and successors of all activities.

The TSI shall provide an initial Bill of Materials (BOM) for all hardware, COTS software, and equipment both supplied and reused under this contract, including spare inventory with the Installation Plan. All COTS hardware manufacturer, vendor contact, model or part number, and feature set information shall be described. The System Detailed Design Document (SDDD) submittal shall include the final BOM. CTRMA shall review and approve both the initial and final BOM.

Table 2-47 provides additional information about the tasks the TSI shall address within the Installation Plan.

Table 2-47: Tasks and Activities Addressed in the Installation Plan

Task	Description
Install Tasks and Activities	Includes all activities and deliverables for the installation of the zone controllers and all roadside devices, including integration to the TFH. These activities include general communications, coordination with CTRMA’s communications office, coordination with the existing maintenance TSI and other contractors of CTRMA, being aware of the current operating condition of all affected subsystems just before scheduled installation, and completion of subsystem training mainly related to handling maintenance alerts/alarms.
Pre-deployment Tasks	Includes tasks and deliverables required for a clean and successful installation and go-live, but that may precede the actual deployment by a few days or weeks. These tasks are where checklists are reviewed, resources are re-confirmed, advance notices of outages are communicated,

Task	Description
	and where agreements on formal roles and responsibilities are documented.
Deployment Tasks	These are the actual go-live tasks that are performed for the implementation, usually starting 24 to 48 hours before go-live. The Work Breakdown Structure (WBS) for the installation task shall include the activities of the involved parties.
Post Deployment Tasks	<p>These are all the quality monitoring and production verification tasks post-go-live to ensure all systems are operating efficiently and as expected, and data is accurately mapped to the TFH. The incident management procedures for go-live shall be included in this section of the plan. These procedures shall include a daily report of all open incidents/tickets since go-live, their status and next steps to resolve, escalation procedures, and how CTRMA and its consultants shall have access and monitoring capabilities during post-deployment.</p> <p>The TSI shall propose a post-implementation support period for up to a maximum of four (4) weeks. This post-deployment period shall include additional TSI resources to monitor the system 24/7, report and communicate degradation in addition to MOMS incidents, and resolve problems. If there are still critical system deficiencies after four (4) weeks, CTRMA may extend this period until all critical items are resolved.</p>

All pre-deployment, deployment, and post-deployment tasks for the Installation Plan schedule shall include at a minimum:

- SECTION 1 – WBS number
- SECTION 2 – WBS name
- SECTION 3 – Resources performing the task activity
- SECTION 4 – Subsystem affected
- SECTION 5 – Task duration (includes start to finish of activities to complete the task)
- SECTION 6 – Planned versus actual time at the start of the task

2.8.2 Installation Meetings

The TSI shall schedule and attend weekly installation meetings during the installation phase of all projects. The TSI and all subcontractors shall ensure that appropriate personnel are present at these meetings. The TSI shall ensure the personnel is authorized to make decisions on behalf of the TSI. Appropriate updates shall be made to the Master Project Schedule, issue lists, status updates, and planned activities. The TSI shall prepare and distribute a meeting agenda at least 24 hours before each installation meeting. This agenda shall consist of those items pertaining to the installation schedule and activities for the previous and current week’s installation efforts. All issues recorded during installation activity for the week shall be discussed and resolved if possible. An open action items list shall also be maintained for any outstanding work items related to the installation meeting(s).

2.8.3 Installation Checklist

The TSI shall develop and submit to CTRMA to review an installation checklist for all TSI installation activities. The checklist shall detail all items required for the installation team to complete the installation process. A copy of the completed checklist shall be provided to CTRMA after the completion of all installation activities. The TSI shall ensure the arrival of hardware on-site (or staged locally) thirty (30) days before the installation. The TSI shall also perform all hardware verifications before the start of the installation. The installation checklist shall include the following, at a minimum:

1. Equipment/Device Description
2. Manufacturer
3. Model Number
4. Serial Number Release (for firmware if required)
5. Operating System (for comparison with design documentation and product-specific cut sheets)

2.8.4 Installation Work Restrictions

Daytime work will generally be allowed but must always be planned and approved by CTRMA. The TSI shall coordinate with CTRMA and cooperate with other civil, electrical, or construction contractors as directed by CTRMA.

2.9 TRANSITION OF EXISTING FACILITIES

The TSI shall be responsible for transitioning from the existing legacy ETCS to the new ETCS. The TSI shall coordinate efforts and schedules with CTRMA's legacy ETCS contractor, their DPS provider, CUSIOP Hub, and the CTRMA's Pay by Mail (PBM) Violations Processing, Collections, and Customer Services contractor, as needed. The TSI shall provide a Transition Plan for each of the CTRMA facilities. This Transition Plan shall describe the methodology, process, and testing required to transition/cutover from the legacy ETCS to the new ETCS.

The transitioning and systems cutover shall ensure that operations are continuously maintained during the cutover process. Interruptions to the processing of tolls, data transmittal and storage, system reporting, system access, toll facility use, and auditing during the cutover period shall be minimized to the greatest extent possible. Any interruptions shall be thoroughly planned and documented in the TSI's transition plan and subject to approval by CTRMA.

The TSI shall begin transition work upon approval of the Work Authorization(s) as described in Section 2.2.1, Work Authorization and Project Delivery. Work Authorization approval is required for the initiation of Phase I, which includes implementation of the TFH and transition of the first facility ETCS. Each additional facility transition, as described in Phase II, shall commence upon successful completion of previous Work Authorizations and approval of each subsequent individual Work Authorizations specific to each facility. Phase III includes the final transition Work Authorization and transition of the last facility and a complete OAT for all previously implemented equipment, software, and systems. The order of the transition of each facility is

projected based on the current End-of-Life (EOL) dates for the currently installed equipment. The TSI may propose alternatives to the transition approached described herein for consideration by CTRMA.

2.9.1 Transition Plan and Full System Transition

The Transition Plan shall describe the TSI's approach to either use as is, upgrade, and/or replace all or some roadside tolling systems. It is assumed for this project that the new ETCS and CTRMA's ITS infrastructure will share space and reside within the same enclosures at certain plazas at the beginning of this contract. The transition plan for each facility shall be tailored for each Work Authorization to address any unique requirements, equipment, or transition considerations specific to each facility.

The TSI shall submit a Transition Plan to CTRMA for review, comment, and approval before the start of any transition activities. The Transition Plan shall provide a comprehensive description of all aspects of the transition activities associated with the project, including the following:

1. Transition approach, including the timing for the transition of system elements and facilities.
2. Information about the transition team.
3. Network cutover and maintenance.
4. Transition readiness assessment, including a risk matrix that identifies transition risks and proposes mitigation or elimination strategies. Reasonable scenarios of transition problems shall be presented and proposed actions to allow the transition to continue.
5. Facility operation during the transitions.
6. Toll Facility Host integration and operation to include image processing, trip building, dynamic pricing, TSI QA/QC, and support for the CTRMA auditing process.
7. Rollback approach, where the TSI shall provide information on how they ensure database integrity with rollback operations.
8. Predecessors and successors for all activities, including entry and exit criteria.

The TSI shall provide an initial Bill of Materials (BOM) for all hardware, COTS software, and equipment both supplied and reused under this contract, including spare inventory with the Transition Plan. All COTS hardware manufacturers, vendor contact, model or part number, and feature set information shall be described. The System Detailed Design Document (SDDD) submittal shall include the final BOM. CTRMA shall review and approve both the initial and final BOM.

The TSI shall provide an installation verification/checklist document to CTRMA for use in verifying that all transitioned systems (hardware) match appropriate design documentation. This checklist shall include the following, at a minimum:

1. Equipment/Device Description
2. Manufacturer
3. Model Number
4. Serial Number Release (for firmware if required)

5. Operating system (for comparison with design documentation and product-specific cut sheets)

Table 2-48 provides additional information about the tasks the TSI shall address within the Transition Plan.

Table 2-48: Tasks and Activities Addressed in the Transition Plan

Task	Description
Transition Tasks and Activities	Includes all activities and deliverables for the installation of the zone controllers and all roadside devices, including integration to the TFH. These activities include general communications, coordination with CTRMA’s communications office, coordination with the existing maintenance TSI and the other CTRMA contractors, being aware of the current operating condition of all affected subsystems just before scheduled transition, and completion of subsystem training mainly related to handling maintenance alerts/alarms.
Pre-deployment Tasks	Includes tasks and deliverables required for a clean and successful cut-over and go-live, but that may precede the actual deployment by a few days or weeks. These tasks are where checklists are reviewed, resources are re-confirmed, advance notices of outages are communicated, and where agreements on formal roles and responsibilities are documented.
Deployment Tasks	These are the actual go-live tasks that are performed for the implementation, usually starting 24 to 48 hours before go-live. The Work Breakdown Structure (WBS) for the transition task shall include the activities of the involved parties.
Post Deployment Tasks	<p>These are all the quality monitoring and production verification tasks post-go-live to ensure all systems are operating efficiently and as expected, and data is accurately mapped to the proposed TFH. The incident management procedures for go-live shall be included in this section of the plan. These procedures shall include a daily report of all open incidents/tickets since go-live, their status and next steps to resolve, escalation procedures, and how CTRMA and its consultants shall have access and monitoring capabilities during post-deployment.</p> <p>The TSI shall propose a post-implementation support period for up to a maximum of four (4) weeks. This post-deployment period shall include additional TSI resources to monitor the system 24/7, report and communicate degradation in addition to MOMS incidents, and resolve problems. If there are still critical system deficiencies after four (4) weeks, CTRMA may extend this period until all critical items are resolved.</p>

All pre-deployment, deployment, and post-deployment tasks for the Transition Plan schedule shall include at a minimum:

1. WBS number
2. WBS name
3. Resources performing the task activity
4. Subsystem affected

5. Task duration (includes start to finish of activities to complete the task)
6. Planned versus actual time at the start of the task

2.9.2 Transition Meetings

The TSI shall schedule and attend weekly transition meetings during the transition of each facility. The TSI and any subcontractors shall ensure that appropriate personnel are present at these meetings. The personnel shall be authorized to make decisions on behalf of the TSI. Appropriate updates shall be made to the Master Project Schedule, issue lists, status updates, and planned activities. The TSI shall prepare and distribute a meeting agenda at least 24 hours before the scheduled meeting. This meeting agenda shall consist of those items pertaining to the transition and schedule for the previous and current week's transition efforts. All issues recorded during the transition activity for the week shall be discussed and resolved if possible. An open action items list shall also be maintained for any outstanding work items related to the transition meetings.

2.9.3 Transition Checklist

The TSI shall develop and submit to CTRMA to review a transition checklist for all TSI transition activities associated with the system. The checklist shall detail all items required for the transition team to complete the transition process. A copy of the completed checklist shall be provided to CTRMA after the completion of the transition activity. The TSI shall ensure the arrival of hardware on-site thirty (30) days before the transition. The TSI shall also perform all hardware verifications before the start of the transition.

2.9.4 Transition Work Restrictions

Daytime work will generally be allowed but must always be planned and approved by CTRMA. The TSI shall coordinate with CTRMA and cooperate with other civil, electrical, or construction contractors as directed by CTRMA.

2.9.5 Reuse of Equipment

The TSI has the option to re-use roadside tolling equipment/devices, along with all existing infrastructure, conduits, cabinets, hub buildings, and electrical and communications equipment and cabling. For any/all re-used equipment, the TSI's delivered system shall conform to the contractual functional and performance requirements for the term of the contract. CTRMA does not assert the condition, functionality, or performance of any currently installed equipment.

If the TSI determines the existing infrastructure requires modification to support the installation of the new ETCS, the TSI shall submit installation drawings detailing installation requirements for CTRMA's review, approval, and professional engineering stamp. The TSI shall maintain all documentation regarding the equipment installation and make it accessible to CTRMA or their representatives upon request.

The TSI shall determine the condition and fitness for the reuse of any currently installed equipment during the site surveys before the submittal of the TSI's Proposals. The TSI will

have additional opportunities to determine the condition and fitness for the reuse of currently installed equipment before each Work Authorization.

Refer to Section 2.3.2, Existing Deficiencies, for additional information on this certification, and Appendix 16, Existing Conditions Report, for information on the existing CTRMA equipment.

The TSI shall provide all other equipment under this Scope of Work to meet the requirements detailed herein and all applicable SLAs, as described in Appendix 7, Service Level Agreement. Additionally, following the appropriate CTRMA-approved equipment disposal procedures, the TSI shall de-install, remove from the premises, and properly dispose of any existing equipment not reused.

If cabinets are full of ITS devices, in addition to the ETCS hardware, the TSI's approach may involve a new cabinet be attached to the existing enclosure, or a new cabinet mounted next to the existing cabinets to create a pass-through via conduits. The new enclosures would provide space for the ETCS equipment, while the old cabinet remains in place for the ITS. If CTRMA relocates the ITS hardware, these conduits could be removed, and a watertight cover placed over the holes to return the cabinet(s) to a National Electrical Manufacturer Association (NEMA)-4 rating.

The transition approach contains distinct phases and scheduling requirements for the transition of each existing facility and implementation of the new ETCS as it replaces elements of the Legacy ETCS. The transition approach requires concurrent activities from the TSI and integration with CTRMA's DPS, which ultimately serves as CTRMA's central transaction processor and gateway to the CUSIOP Hub and CTRMA's PBM back office. CTRMA has defined a transition approach described in the following sections. TSI's may propose an alternate transition approach for CTRMA's consideration. Any proposed transition approach must adequately address cost, risk, schedules, continuity of service, and operational efficiency during and after the period of transition.

2.9.6 Transition Phases

The transition approach is divided into three overall phases, generally delineated by the successful completion of major milestones in the preceding phase. Checklists for Phases I, II, and III can be found in Table 2-49. These dates are subject to change pending approval of the Master Project Schedule.

Table 2-49: Transition Phases/Completion Milestones

2.9.6.1 Phase I Transition

This phase includes the design, development, fabrication, and testing of all software and components of the ETCS, including the successful performance of a TFH Factory Acceptance Test (FAT) and Roadside FAT. The TSI shall perform each FAT with the participation of CTRMA and CTRMA's representatives. The transition from the Legacy ETCS to the new ETCS will require several steps. These steps are defined in Table 2-50 and depicted in Figure 2-20 through Figure 2-24.

Steps 1 - 3 are not the responsibility or within the scope of the new TSI's work but are prerequisites for the Phase I transition to begin.

Table 2-50: Phase I Transition Steps

Step	Phase I Activities	Reference Figure
Step 1 (CTRMA)	Implementation of CTRMA's DPH: <ol style="list-style-type: none"> 1. CTRMA develops and implements the CTRMA DPH. 2. CTRMA's DPH is fully functional and ready to begin integration testing. 	Figure 2-20
Step 2 (CTRMA)	Integration of CTRMA's DPH to the CUSIOP Hub and CTRMA's Pay By Mail back office system: <ol style="list-style-type: none"> 1. CTRMA completes certification testing with CUSIOP. 2. CTRMA completes testing with CTRMA's Pay By Mail back office system contractor. 	Figure 2-21
Step 3 (CTRMA)	Transition of Partner RMA interfaces from Legacy TSI Host to the CTRMA DPH: <ol style="list-style-type: none"> 1. For CTRMA to decommission the Legacy TSI Host, NET RMA and CCRMA must transition to the DPH. 2. The DPH will now serve as a gateway for partner RMAs to exchange data with the CTRMA PBM BOS and the CUSIOP Hub. 3. CCRMA operates its own BOS independently of CTRMA/NET RMA. 	Figure 2-22
Step 4 (TSI)	The New TSI designs, develops, tests, and integrates the new TFH to CTRMA's DPH: <ol style="list-style-type: none"> 1. The new TSI will implement and test the new TFH to ensure the TFH can communicate with the DPH and is ready to accept transactions from CTRMA's existing roadside facilities. 2. All reporting, auditing, and reconciliation continue through the Legacy ETCS. 3. The new TFH is to be ready to process VES images, transactions, transmit all required data to the DPH, and generate all required reports. 4. The new TFH is thoroughly tested, and all functionality is validated, including: <ol style="list-style-type: none"> a. AVI and video transaction processing b. Trip building c. Dynamic pricing d. Lane monitoring and control e. Reporting f. MOMS g. Equipment monitoring h. DPH integration testing completed 	Figure 2-23
Step 5 (TSI)	The TSI begins the transition of the first facility from the Legacy ETCS to the new ETCS and the new TFH:	Figure 2-24

Step	Phase I Activities	Reference Figure
	<ol style="list-style-type: none"> 1. The new TSI prepares for equipment installation, testing, and cutover of the first roadside facility from the Legacy ETCS to the new TSI ETCS. 2. Roadside FAT testing has begun. 3. Roadside FAT data has been compiled, reviewed, and approved by CTRMA. 4. The transition of all in lane hardware at 290 Toll is complete. 5. All legacy hardware is appropriately disposed of according to the CTRMA policy. 6. New toll lanes transactions at 290 Toll are flowing directly to the new TFH. 7. Toll transactions for the transitioned facility are now processing through CTRMA’s DPH and submitted to the CUSIOP Hub and CTRMA’s Pay By Mail BOS for further processing. 8. The network is transitioned over to the new TSI for transitioned facilities. 9. Site Commissioning is complete at 290 Toll. 10. Legacy system components are disposed of per the CTRMA requirements. 	

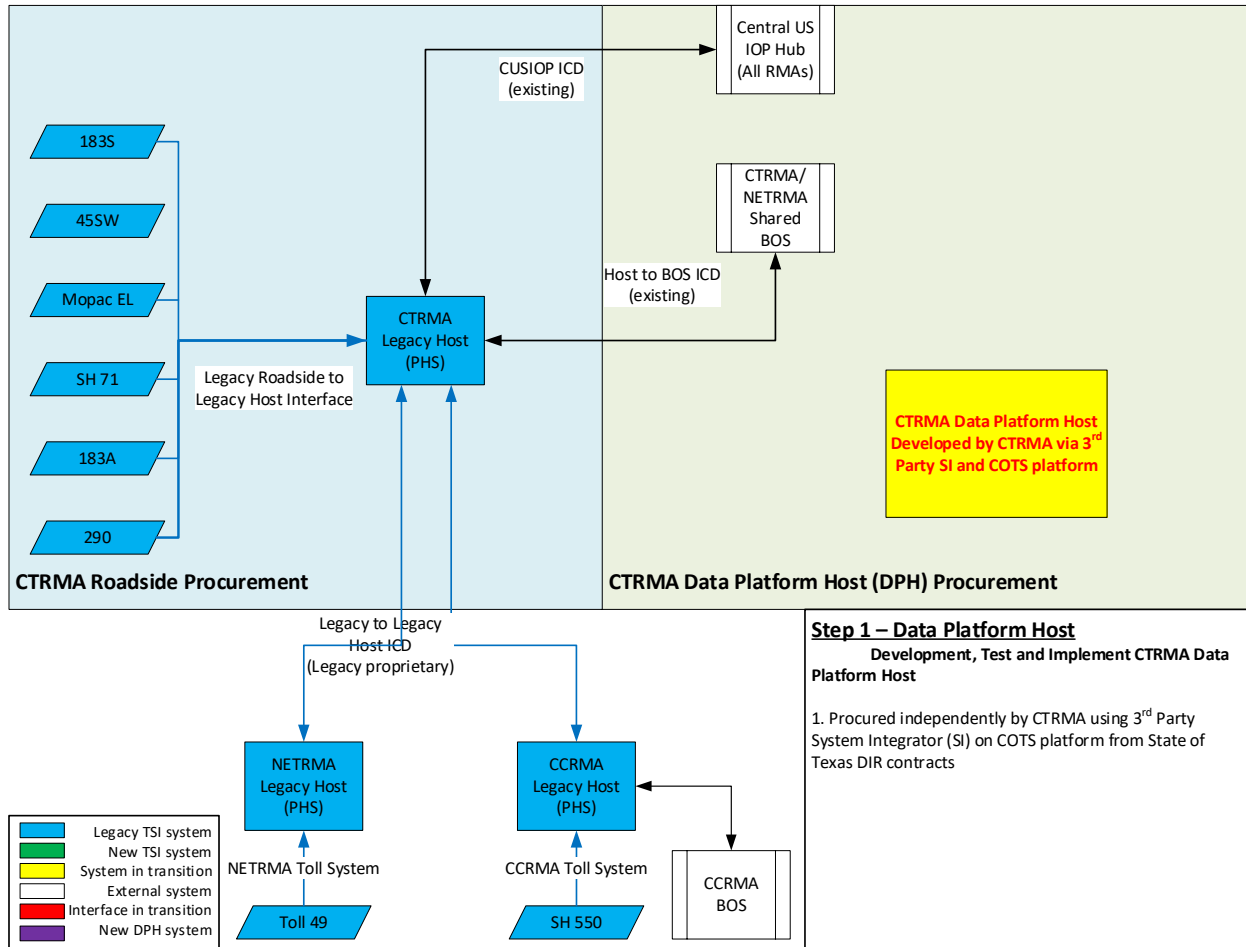


Figure 2-20: Step 1 - Implementation of CTRMA's Data Platform Host

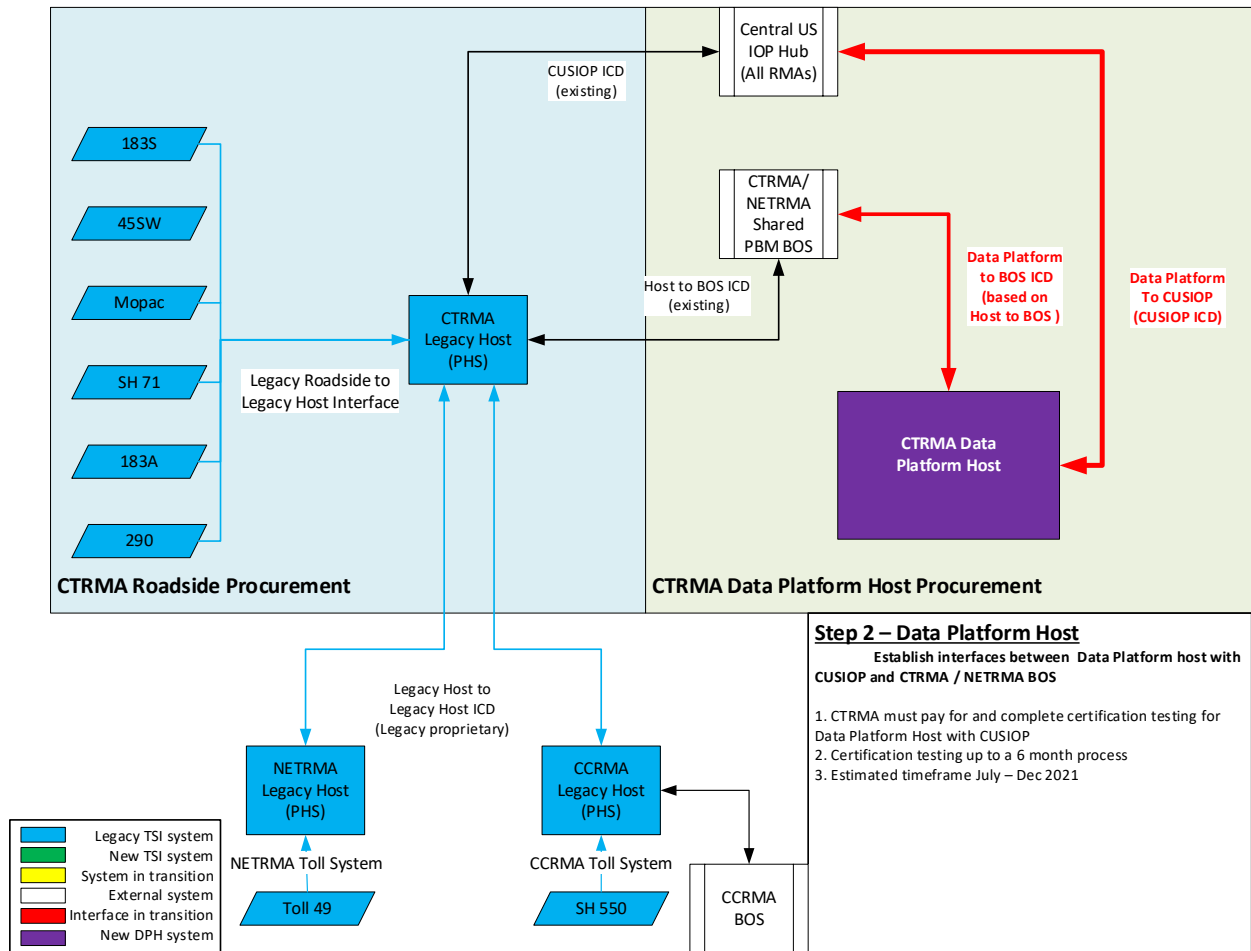


Figure 2-21: Step 2 - Integration of CTRMA's Data Platform Host

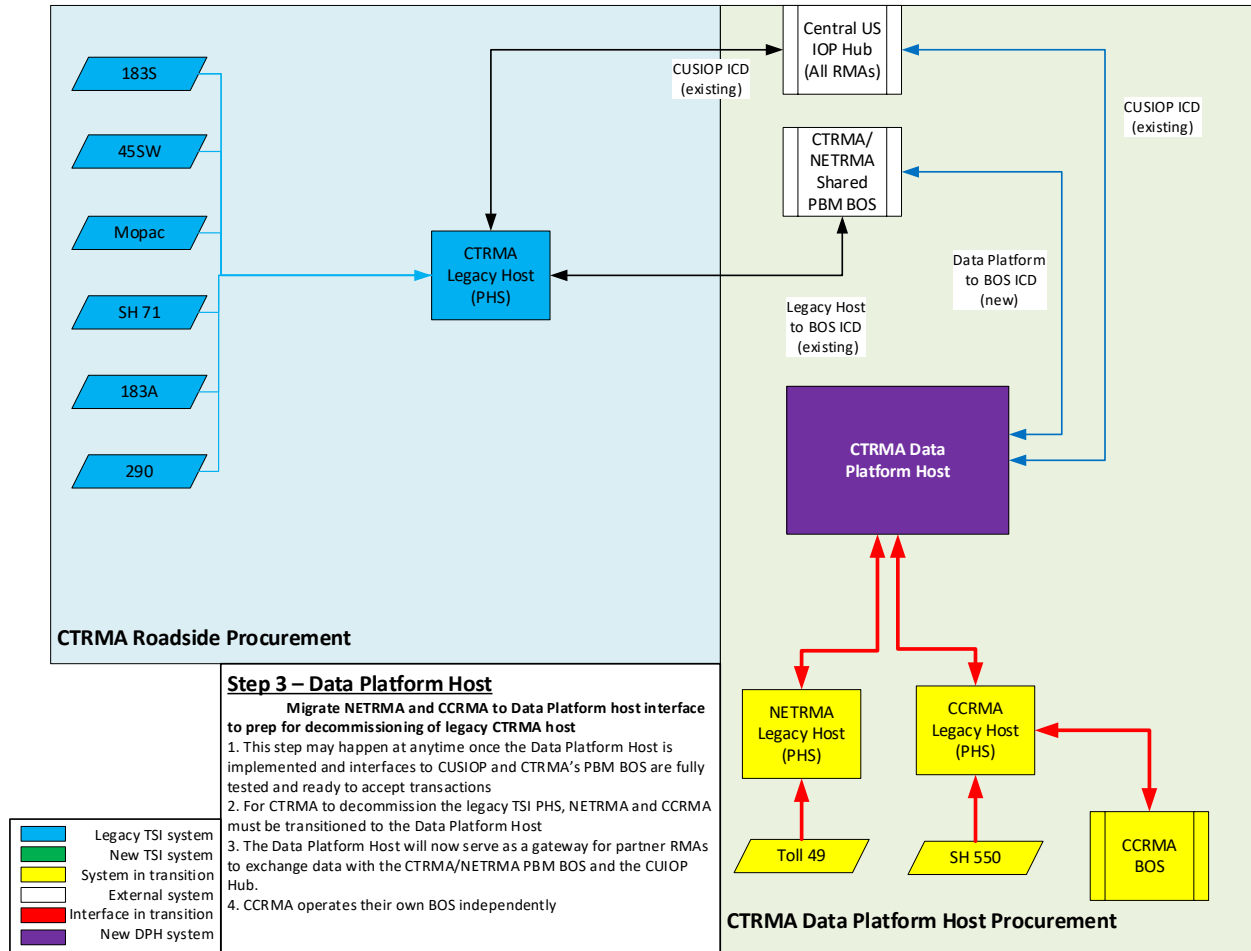


Figure 2-22: Step 3 - Transition of Partner RMA interfaces from legacy TSI Host

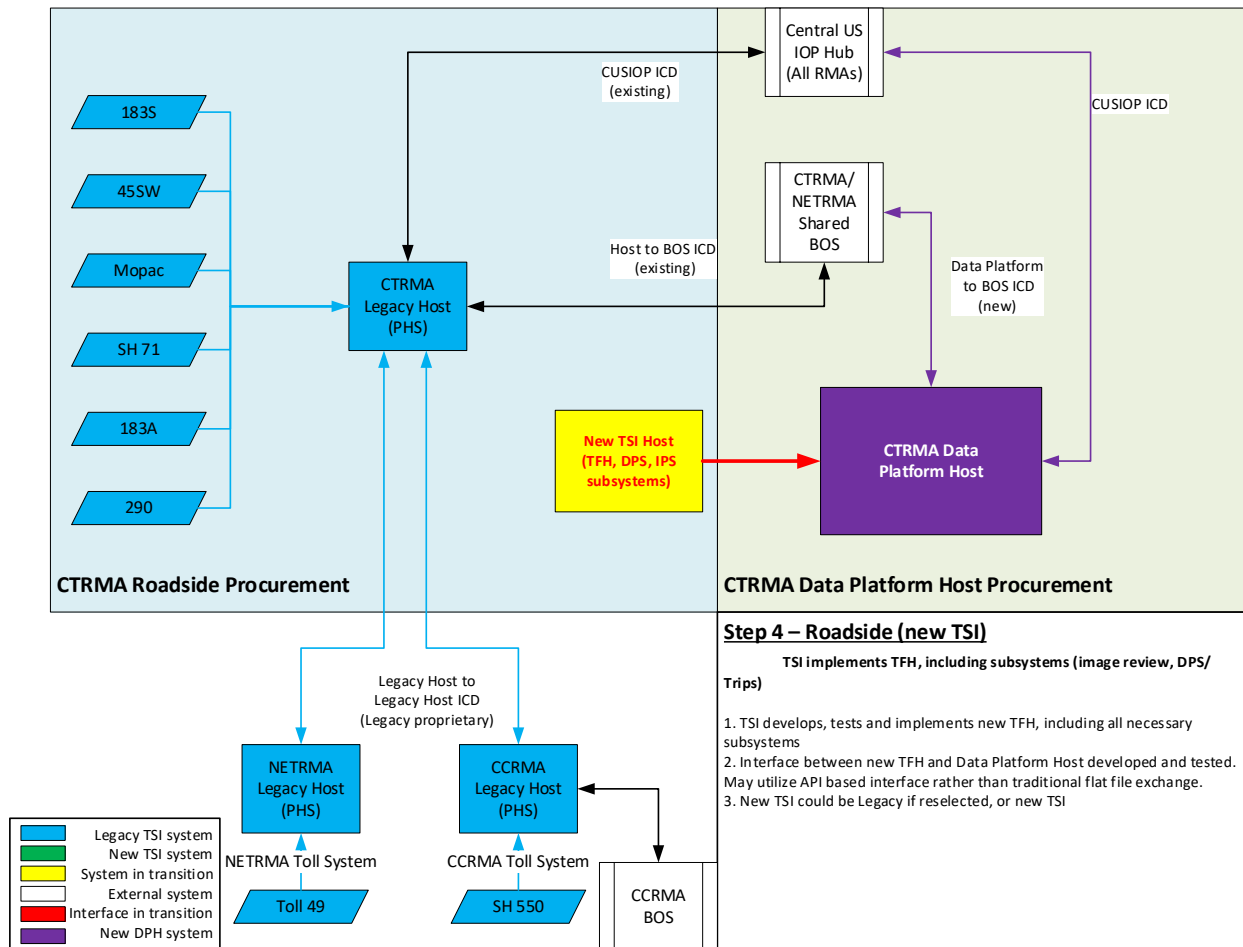


Figure 2-23: Step 4 - New TSI designs, develops, tests, and integrates the new TFH

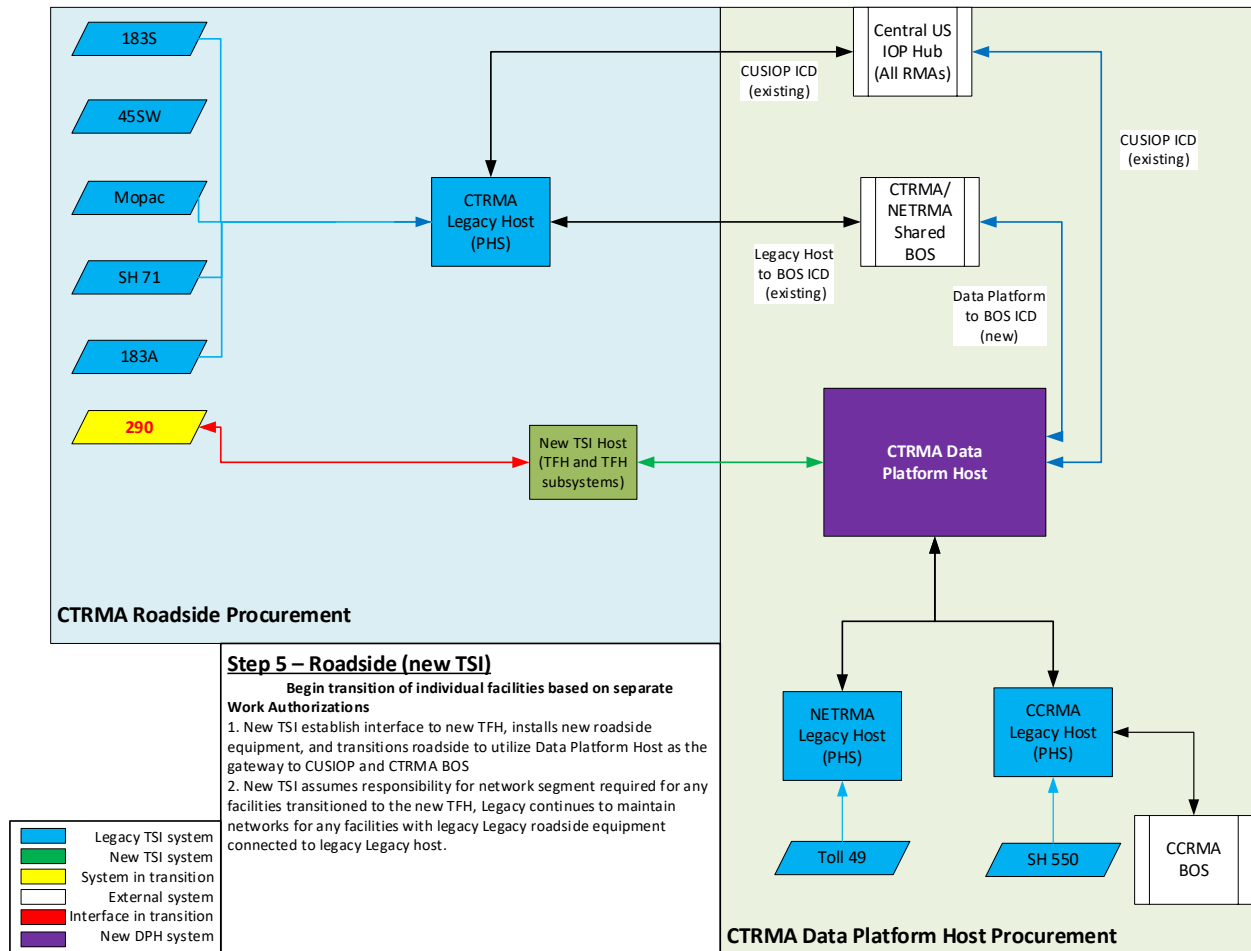


Figure 2-24: Step 5 - TSI begins the transition of the first facility

2.9.6.2 Phase II Transition

This phase includes all field equipment installations on the remaining CTRMA facilities, on-site testing, and debugging and commissioning testing. The transition of each phase requires Work Authorization development and approval by CTRMA.

Phase II toll facility conversions may occur in the order shown in Table 2-51. The following schedule is based on original installation dates and expected EOL dates for the installed equipment. The EOL dates represent the maximum duration the existing equipment may remain in use based on the TSI’s proposed Transition Plan and reuse of currently installed TSI equipment before it must be replaced. This schedule may be adjusted (accelerated or reordered) based on the TSI’s proposed alternative transition schedule and agreement by CTRMA.

Table 2-51: Phase II Transition Schedule

Facility	Hardware Refresh Year	Equipment life expectancy (+7 years after installation)
290 Toll	2015 and 2020	2022 and 2027
183A Toll	2017 and 2018	2024 and 2025
71 Toll Lane	2017	2024
MoPac Express Lane	2017	2024
45SW Toll	2019	2026
183 South Toll	2019, Phase 2 2020 (<i>under construction</i>), and Phase 3 2022 (<i>under construction</i>)	2026, 2027 and 2029

This phase includes all field equipment installations on the remaining CTRMA facilities, on-site testing, and debugging and commissioning testing.

Table 2-52: Phase II Transition Steps

Step	Phase II Activities	Reference Figure
Step 6 (TSI)	<p>Transition of existing toll facilities to the new TFH continues:</p> <ol style="list-style-type: none"> 1. Transition of the existing toll lanes to the new Toll Facility Host continues. 2. Transactions are forwarded from the new TFH to CTRMA’s DPH. 3. The transition of each facility is managed with individual Work Authorizations approved by CTRMA. 4. As each facility is transitioned, the TSI is responsible for SLAs and maintenance. 	Figure 2-25
Step 7 (TSI)	<p>Complete transition of existing toll facilities:</p> <ol style="list-style-type: none"> 1. Transition of the existing toll lanes to the new TFH continues until all facilities are transitioned. 2. All transactions are forwarded to CTRMA’s DPH. 3. Complete network is transitioned over to the new TSI. 	Figure 2-26

Step	Phase II Activities	Reference Figure
	4. The new TSI is responsible for all Legacy Plazas across all the CTRMA facilities. 5. Legacy TSI no longer has access to any aspect of the Legacy ETCS or network. 6. All the spare parts of CTRMA have been transferred over to the new TSI. 7. All reporting, audit, and reconciliation is now through the new TFH and DPH.	

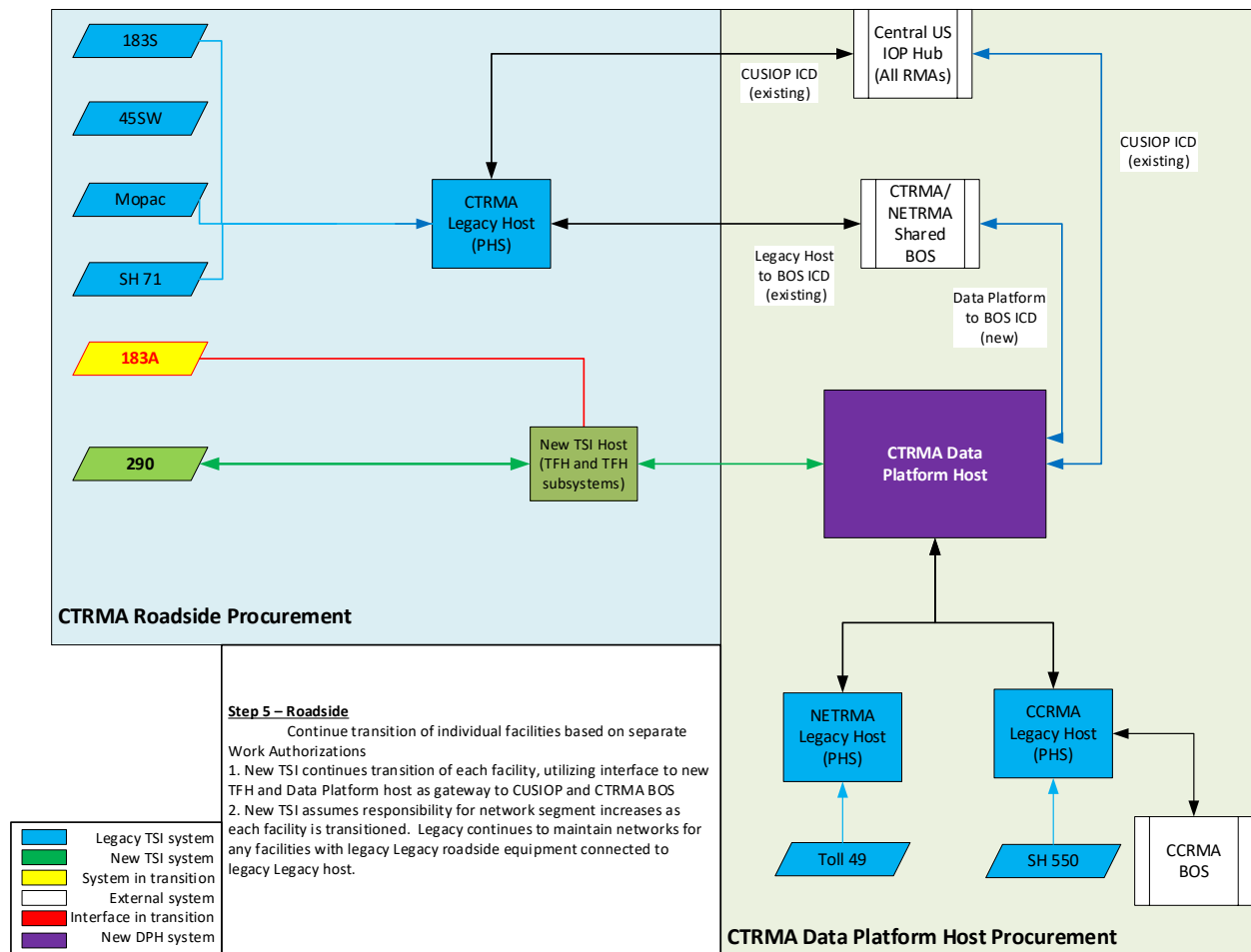


Figure 2-25: Step 6 - Transition of existing toll facilities to new TFH continues

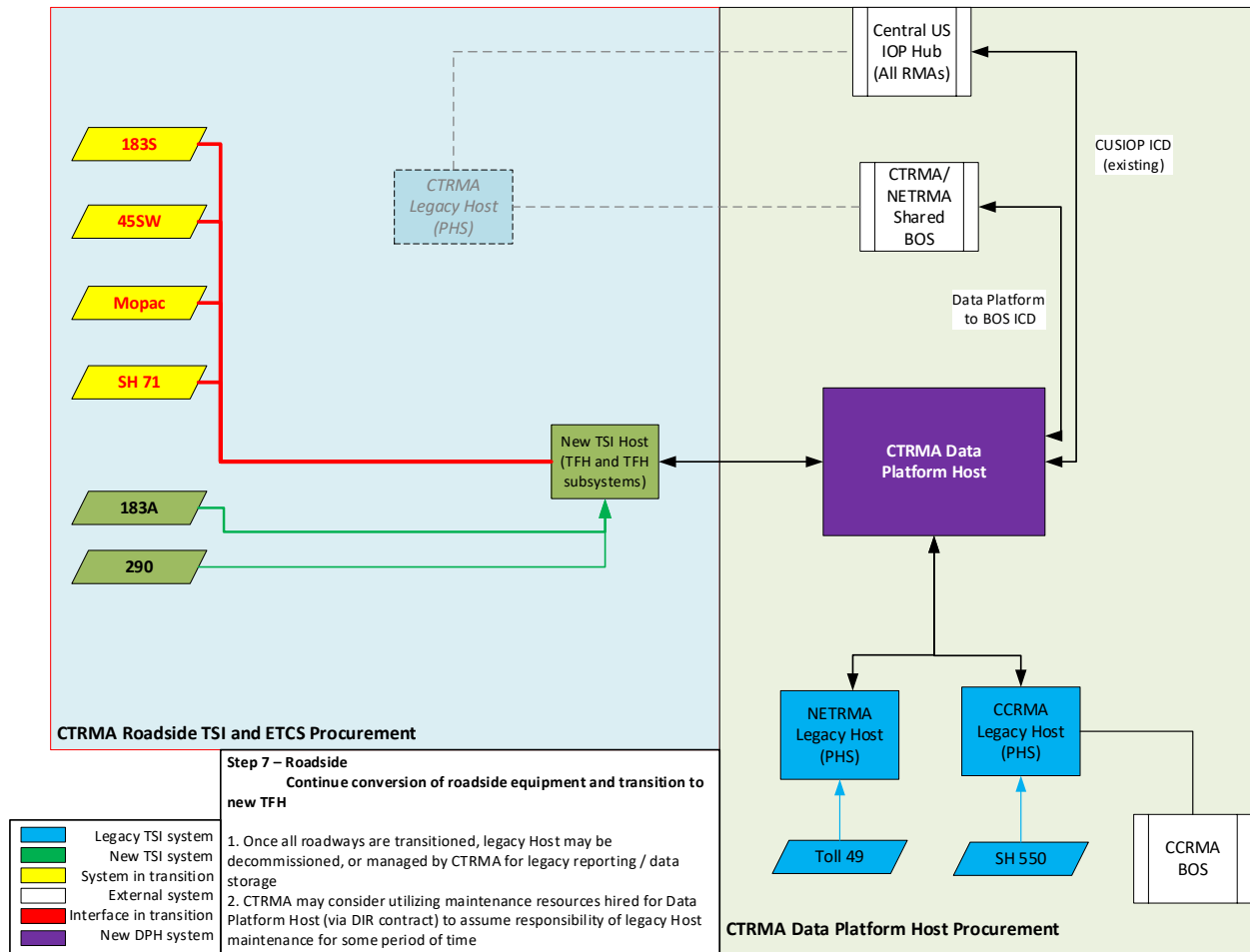


Figure 2-26: Step 7 - Complete transition of existing toll facilities

2.9.6.3 Phase III Transition

Phase III is a period of thirty (30) days after Phase II is completed. This phase shall act as a “Closeout” phase for the Work Authorizations. Phase III will be considered complete when the TSI has provided a letter of closeout demonstrating the following:

- Met the criteria of each milestone trigger in the C-60 Payment Milestone
- Provided a monthly performance report for each of the production plazas within the previous thirty (30) days
- Confirmed there are no open P1/P2 defects at the time of the closeout request

Table 2-53: Phase III Transition Steps

Figure 2-27: Step 8 – Final System Acceptance of complete ETCS

2.10 MIGRATION/MIGRATION PLAN (REMOVED FROM SCOPE OF WORK)

The data migration requirements have been removed from the RFP scope until further discussions can occur with the selected system integrator. CTRMA plans to migrate the majority of the data to the DPS.

2.11 PROJECT DOCUMENTATION

CTRMA will accept no more than three (3) original first submittal documents from the TSI per review cycle. CTRMA shall accept additional documents within a review cycle provided the additional documents represent materials previously reviewed by CTRMA, and now contain new TSI updates that address CTRMA comments.

The TSI shall maintain a tracking tool, posted in an accessible location to CTRMA, for maintaining document submittal and review status. The TSI shall update the tool weekly for document submittals in a two (2) week look ahead, and in real-time for submittals sent to CTRMA for review, and for reviewed documents received from CTRMA.

Note: The Transaction Aggregation functionality is an option to be determined by CTRMA. If CTRMA decides for the TSI to implement transaction aggregation, this functionality shall be addressed in the appropriate documentation, including testing.

2.11.1 Requirements Traceability Matrix

The TSI shall prepare and submit a Requirements Traceability Matrix (RTM) during the system requirements and design phase of the project. The RTM shall document, at a minimum, the following:

1. All requirements as described herein with a unique ID and unchanging number.
2. The intended primary and secondary (if any) means used to verify the requirement, such as inspection (I), analysis (A), demonstration(D), or test (T).
3. The uniquely identified test procedure or script number used to verify a requirement.
4. The date verified (to be used during testing and verification).

The RTM shall trace verification of all requirements contained in the RFP back to their source (e.g., RFP, or Business Rule, or via discovery) and forward to their design element and eventual test cases.

The RTM shall include the following, at a minimum:

1. System requirements shall reflect its associated RFP section numbers for each requirement (to lowest level section).
2. Business rules shall be linked and can be traced to its associated system requirements.
3. Derived requirements from CTRMA's Business Rules that cannot be linked to the RFP system requirement.
4. Engineering requirements derived from RFP requirements that result in a testable set of requirements.
5. Design elements contained in the SDDD (to lowest level section).

6. Verification method.
7. Test cases as applicable per verification method.
8. Training modules as applicable.
9. The TSI shall maintain the documentation traceability of RTM by the document management system and as part of change control for the duration of the contract. In this way, a change order or defect/deficiency fix or repair could result in changes to other components or system elements and therefore require an update to the RTM. Refer to Section 2.7.6.5 for more information on the document management system. After system acceptance, the TSI shall provide any changes to the RTM. These changes shall be submitted to CTRMA for approval.
10. The TSI shall update the RTM for each facility Work Authorization and through the maintenance period.

The TSI may include additional tracing elements information in the RTM to assure all requirements are accounted for as part of the design and development phases before commencing system testing.

2.11.2 Interface Control Documents

As part of the requirements phase for the project, the TSI shall define a list of interfaces and related requirements for the project. During the design phase, the TSI shall develop appropriate ICDs for CTRMA's review, comment, and approval. These ICDs shall fully describe the interfaces, including file formats, message delivery guarantee structure and receipt acknowledgment, error checking and handling, retransmission procedures, archiving, and other related specifications.

These ICDs shall address the physical, functional, and performance aspects of all interfaces. Data flow diagrams shall be used to illustrate the objectives of the interface. The ICD shall provide information on the proposed security protection consistent with the public exposure of the interface data.

The TFH shall be required to interface with CTRMA's DPS.

2.11.3 System Detailed Design Documents (SDDD)

As part of the design phase of the project, the TSI shall submit an SDDD that provides the proposed system architecture, design specifications of all equipment, hardware, and communications/network gear, and a description of the software functionality and associated data flow. The development of the SDDD shall begin with a thorough discovery process for capturing and updating all applicable CTRMA Business Rules and requirements. The CTRMA Business Rules can be found in Appendix 10, Lane System Business Rules. Proposed items and equipment shall meet electrical, communication, and environmental requirements and shall be compatible with expected loads, exposure, and peak usage. Software design shall describe the various modules intended to provide functionality and processing, as required by CTRMA.

The SDDD shall present the logical design of the ETCS, including data flow diagrams for various processing queues, entity-relationship diagrams, and the data dictionary.

During the design phase of the project, the TSI's draft submission shall be followed by an initial review and comment period, after which design reviews shall take place. Upon completion of design reviews, the SDDD shall be revised and re-submitted to CTRMA for final review and approval.

The SDDD shall include the following, at a minimum:

1. The specification sheets for all equipment, including a full hardware manual set for all COTS hardware and compliance matrix, relative to requirements
2. Full description for all COTS software, including software manual sets
3. Computer/server sizing and design details
4. The system, subsystem, and module-level descriptions and interaction between modules
5. Comprehensive schema describing the database(s)
6. Business Rules
7. The requirements for all peripheral device interfaces
8. Description of system diagnostics, status monitoring, and error handling.
9. Description of redundancy and failover processes
10. Interface Control Documents
11. File and transaction and maintenance message formats
12. User interface design, including menus and screens
13. Database design including entity relationship modeling and data dictionary
14. Data integrity assurance plan
15. System and physical security design description and layout
16. Data communications/network diagram highlighting proposed changes and interconnection points
17. Estimated data communication load and existing bandwidth capacity

The SDDD shall include the following network administration information:

1. Network architecture with a graphic representation of all hardware components, their interconnections, and identify interfaces to other toll system elements as well as any external systems.
2. Provide data loading analysis that identifies the type, amount, and frequency of data transmission as well as the data flow through all communications paths. An analysis of bandwidth requirements for each data path shall be provided.
3. Detailed diagrams and technical specifications of network components, hardware, software, communications protocols, and network topologies to be used in the system design.
4. Techniques utilized to ensure the network(s) shall meet the volume of transaction/data traffic to meet the system performance requirements.
5. Rack, cabinet, and enclosure layouts for each network location, including the dimensions of each.
6. Tools and processes used to detect and isolate failures.

The TSI shall provide read-only database access of the production system or another database instance where the data is recent up (to a day old) to authorized users of CTRMA and its third-party consultants. The TSI shall provide cut sheets for all equipment that is provided for the ETCS and, where cut sheets are not available, links to web sites with product details, specifications, and requirements shall be provided.

The TSI shall submit the as-built SDDD, including all changes made during the software development, installation, and testing phases per Appendix 13, Project Deliverable Schedule.

As the new facilities come online, the TSI shall update the as-built documentation through the document management system.

2.11.4 Disaster Recovery Plan

The TSI shall provide a Disaster Recovery Plan (DRP) for CTRMA's review, comment, and approval. The DRP shall include the following, at a minimum:

1. Initial subsystems damage assessment procedure and checklist
2. Architecture and description of redundant subsystems and failover processes
3. Maximum successful failover time to DR/redundant site as confirmed by annual failover testing 8 hours
4. Roadside equipment data latency assessment.
5. Emergency contact list
6. Personnel roles and responsibilities
7. Details of the procedures/processes used in the event of the complete destruction of a TFH site, including relocation plans
8. Business Continuity Plan
9. The disaster recovery plan shall be kept current throughout the life of the contract and tested as part of Integration testing, and annually thereafter

2.11.5 Backup, Recovery, and Data Archive Plan

The TSI shall develop and submit a Backup, Recovery, and Data Archive Plan during the design phase of the project for CTRMA's review and approval. This plan shall address all aspects of the backup, recovery, and archive strategies and processes, including the following:

1. Backup and recovery plan for all applications, databases, and storage subsystems
2. Backup and recovery plan for all roadside subsystems (e.g., zone controllers and VES data processing units/controllers)
3. Integration with MOMS to include alerts and notifications of the success or failure of backup systems or jobs
4. Details on data archiving: disk to disk, disk to selected media, and rotational schedule of selected media and offsite storage as well as the frequency of full and incremental data backup for all servers/systems

The TSI shall demonstrate the Backup, Recovery, and Data Archive Plan during system integration testing, and then annually after that. CTRMA or the CTRMA-designated representatives shall witness this demonstration.

2.12 TRAINING PROGRAM

The following sections provide information regarding the training program.

2.12.1 General Training Requirements

The TSI shall provide training designed to educate the CTRMA-designated personnel in the operation, use, and maintenance of the ETCS. A training course and materials shall be designed to support training during the implementation phase.

CTRMA shall provide a facility for conducting the training session. The TSI shall make reservations for any use of the CTRMA training rooms in advance. The training session can only be conducted between the hours of 9:00 am to 3:00 pm Monday through Friday. The TSI shall plan the training course, content, and resources such that up to six (6) trainees could be trained at once. The TSI shall provide its training equipment, including projectors and laptops.

The TSI shall deliver and maintain training materials including instructor guides, student workbooks, self-guided tutorials or videos, and all training course content including visual aids, technical manuals, diagrams, PowerPoint presentations, and loose handouts as needed for any TSI delivered training. The TSI is responsible for any needed updates to training materials discovered during live training sessions. All training course content, training materials, and documentation shall be reviewed and updated as needed to stay current as part of any change orders and as part of the maintenance of the RTM. On an annual basis, training content that is no longer relevant shall be purged from the training curriculum. Any changes or purging of training content shall be pre-approved by CTRMA.

2.12.1.1 Training Plan

The TSI shall develop a Training Plan for CTRMA's review, comment, and approval. The Training Plan shall include a sample training course with sample training materials so that CTRMA can review and provide comments on the TSI's training content delivery methodology and the overall intended look and feel of training content and materials. The TSI shall submit and gain comments and approval on its Training Plan before developing and submitting the individual training courses to CTRMA for approval. Additionally, the Training Plan shall provide the following for each training course:

1. The purpose of the course
2. The qualification requirements for the trainer(s) and the intended audience
3. Course content outline/summary
4. Estimated training course duration
5. Training materials to be provided
6. All equipment required for delivery

7. Any logistical requirements, such as if the training is to be conducted in a classroom or roadside

Following the approval of the Training Plan, specific training course content and materials shall be submitted to CTRMA for review, comment, and approval. The training course shall be included as an addendum in the Training Plan and shall be customized to meet the needs of the intended audience.

Once the course is approved, the TSI shall produce sufficient copies of the training course material as needed to accommodate the estimated number of personnel who shall attend each training class and maintain a reproducible set of documentation electronically as part of the RTM. The Training Plan shall include how all training materials shall be generated and maintained electronically over time so that at the end of the contract, all training materials are current. Additionally, the Training Plan shall describe how the TSI's training staff shall coordinate with the TSI's documentation and requirements traceability resources to ensure all training content is maintained as part of the RTM.

2.12.1.2 Training Course

The TSI shall provide, at a minimum, the following training course for CTRMA's review, comment, and approval. The training course shall be developed, reviewed, and updated based on CTRMA's review and comments, and added as addendums to the Training Plan.

The courses shall provide students with an understanding of the ETCS, including hands-on training. These courses are designed primarily for the CTRMA managers, public information and marketing staff, Information Technology (IT) personnel, and others who require a basic understanding of the entire ETCS. These courses shall discuss system functionality, including, but not limited to, the lane, the TFH, trip building, and dynamic pricing, user, and other relevant interfaces.

These courses shall be offered three times during the Training Program and shall provide information on the following:

1. High-Level Overview of Entire Solution
 - a. TFH
 - b. Interfaces
 - c. Roadside System
 - d. Digital Video Audit Systems (DVAS) system
 - e. Audit and Reconciliation
 - f. Dynamic Pricing and Trip Building
2. Reporting
3. MOMS

2.12.1.2.1 Training Program Delivery Schedule

The TSI shall develop a training schedule (as part of the project schedule), which identifies the delivery of the full set of training materials, including instructor guides, student workbooks, and all training course content for CTRMA's review, comment, and approval.

Additionally, all courses (training material, manuals, and training classes) must be delivered to the CTRMA trainees to ensure that CTRMA and their authorized representatives are adequately prepared to evaluate system performance before and during system integration and OAT.

All training courses must be completed before System Integration Testing (SIT).

2.13 SYSTEM TESTING

The TSI shall conduct testing of the ETCS to validate functionality, availability, reliability, accuracy, and compliance to the requirements of this RFP or any changes to requirements due to change orders or break/fix activities. This includes all functionality delivered by the proposed ETCS and all third-party components.

The TSI shall conduct internal tests of the ETCS and interfaces (dry runs) following approved test plans and procedures before CTRMA observes formal test phases. Internal (dry run) testing shall be successfully completed by the TSI no less than two weeks before the formal test phase that it precedes. The TSI will provide the results of these dry runs to CTRMA before the commencement of the formal and observed tests. CTRMA may require the TSI to re-run the internal tests before conducting a formal and observed test if the preliminary test results do not indicate the test would be passed per the test plan and procedures.

The TSI shall document, by way of an issues list, all defects and issues discovered during formal and observed test phases. All issues and defects shall be assigned a resolution date and severity/priority level. This issues list shall be provided to CTRMA within two (2) days of completion of the formal test phase. The TSI shall be responsible for tracking all defects and issues found during all testing phases until a complete resolution is reached with CTRMA's approval. CTRMA may require that updates to this issue list be submitted to CTRMA and software demonstrations performed to verify that the updates have been completed. All defects must be fixed, tested, and resolved to CTRMA's satisfaction in each formal test phase before moving onto the next phase of testing or final system acceptance. At CTRMA's sole discretion, minor defects may be allowed to be scheduled for resolution after the completion of a formal test phase.

The TSI shall maintain and have readily available a test environment operating the current ETCS production software version for the duration of the contract, for the following, at a minimum:

1. Change order deployment and demonstration
2. Defect triage and break-fix
3. Toll Interoperability changes
4. Third-party interface testing

2.13.1 Master Test Plan

The TSI shall submit a Master Test Plan to CTRMA for review, comment, and approval. This Master Test Plan shall provide the standards for developing individual test plans and procedures for the different phases of formal testing. These standards shall describe how each formal test shall be conducted, document test procedure format, discrepancy/issue/defect

severity level definitions, discrepancy/issue/defect tracking, and the entry, exit, and acceptance criteria for each test phase. CTRMA must approve entry and exit criteria for all test phases. All functionality delivered by the ETCS shall be demonstrated/tested, and the Master Test Plan shall describe these demonstrations and guidelines for creating test procedures in the individual test plans. The Master Test Plan shall describe the overall testing strategy and test procedure standards, whereas each formal test shall have its own test plan comprised of detailed test cases and procedures.

The TSI shall use the following priority levels with associated descriptions for all test phases and describe their approach to the handling of these priority levels in the Master Test Plan.

1. **Priority One:** A defect that stops the execution of an individual test and causes the execution of related tests not to be executed. This class of defect is reserved for problems that require testing to stop and shall be used only for the most critical of defects. Typical characteristics of this class of defect include the following:
 - a. The defect is related to a legal or revenue issue that must be resolved before deployment. The system cannot go into production until the defect is fixed.
 - b. The defect will result in a customer-facing issue for CTRMA.
 - c. It will directly impact users or operations in a major, noticeable way.
 - d. It occurs (or will occur once the application is released) quite often (e.g., daily) in actual production or simulation.
 - e. There is no real workaround.
 - f. The defect causes downtime to the point the applicable availability SLAs is not able to be met for the OAT period.
2. **Priority Two:** A defect that stops the execution of an individual test but does not affect the execution of other related tests. This may also be a defect that blocks any test or presents an unavoidable problem, preventing a user from completing the required tasks. Typical characteristics of this class of defect include the following:
 - a. It directly impacts users, or operations, in a major, noticeable way.
 - b. It occurs (or will occur once the application is released) fairly often (at least once a week) in actual production or simulation.
 - c. The problem causes application downtime or blocks test/test sets.
 - d. There is no real workaround, or there is only one workaround that requires significant effort on the part of the user.
3. **Priority Three:** A defect for which a workaround is available. The actual results of current tests are not as expected, but the defect does not prevent the continued execution of the tests. Includes defects that impact the system or subsystem, but the system or subsystem is still able to perform without an immediate fix. Typical characteristics of this class of defect include the following:

- a. It occurs (or will occur once the application is released) less often than weekly in actual production or simulation.
 - b. The defect does not cause significant application downtime.
 - c. The defect is not functioning as documented or expected.
4. **Priority Four:** A cosmetic defect whose occurrence does not indicate a lack of or deviation from required functionality, but a cosmetic change or enhancement is requested. Workarounds are available so that system users can avoid these defects. Typical characteristics of this class of defect include the following:
- a. It relates to content, documentation, or other "non-application" aspects of the system or subsystem.
 - b. If functionally related, the problem seldom occurs (or seldom will occur once the application is released) in actual production or simulation.
 - c. Users have not noticed, or are unlikely to notice, that there is a problem.

As design and development activities take place, testing strategies and plans may change and require revisions. As such, throughout the implementation phase, updated versions of the Master Test Plan and related test documents (individual test plans and final test reports) shall be revised or appended to the Master Test Plan and delivered to CTRMA for review and approval. In this way, the Master Test Plan will stand as a record of all testing performed during development, implementation, and acceptance. After OAT, system testing shall be managed as part of the TSI's QMP. This plan shall address QA testing and regression testing to verify changes to the ETCS, including equipment, hardware, application, database, operating systems, COTS upgrades, and all types of patching.

Formal tests shall conform to the standards defined in the Master Test Plan. For formal tests that require test cases/procedures (e.g., FAT, Commission, and Integration testing at a minimum), test cases/procedures shall include the following elements, at a minimum:

1. Introduction
 - a. Test purpose
 - b. Test platform (including required equipment, environmental resources, and connectivity)
 - c. Requirements to be demonstrated (cross-referenced to the RTM)
 - d. Time estimate
 - e. Prerequisites
 - f. Set-up and test data preparation needed
2. Individual Test Conditions/Steps
 - a. Description of steps to execute the test case
 - b. Expected results for each step
 - c. Actual results and the party responsible for executing the test (entered after test execution)
 - d. Pass/Fail checkbox for each step
 - e. Notes/comments

As test cases for specific formal tests are developed, they shall be submitted to CTRMA for review, comment, and approval. Once approved, the test cases (and later the results) shall be added to the Master Test Plan as addendums.

2.13.2 Test Reports

No more than ten (10) days following the completion of each formal test, the TSI shall submit a Test Report to CTRMA for review and approval. The Test Report shall describe:

1. Test phase (e.g., FAT, SIT, OPS)
2. Description of the testing process
3. Results of the test
4. Listing of all defects identified along with the severity level of each defect
5. Plan for resolving defects
6. Recommendation for retests (if appropriate)

The final approved test report for each formal test shall also be added to the Master Test Plan. CTRMA reserves the right to withhold approval and any associated payments pending completion of corrective action and any necessary retests.

During FAT and SIT, the TSI shall submit daily progress reports that contain the following:

1. Total test cases executed
2. Total test cases closed (% complete)
3. Total defects opened
4. Total defects closed
5. Remaining open defects by priority

2.13.3 Factory Acceptance Test

The TSI shall conduct a Factory Acceptance Test (FAT) to demonstrate that all requirements and functionality have been incorporated into the ETCS. FAT shall demonstrate to CTRMA the full functionality of the ETCS operating in a test environment with hardware and software representative of the final system as deployed to and running in production. The FAT will demonstrate all requirements of the system, as documented in the RTM and the SDDD. The FAT will include a system performance test that demonstrates that the system will handle twice the expected transaction volumes, as taken from the existing CTRMA facilities. CTRMA or CTRMA's representatives will observe the formal FATs.

All ETCS functionality, including roadside, TFH, capacity/performance, interfaces, and ease of use (GUIs), shall be tested and demonstrated during FAT. All system reports shall be generated from the ETCS to verify that delivered reporting functionality meets the requirements. Reports testing shall utilize test data sets. Internal and external interfaces shall be observed and verified against requirements and for data accuracy. As the availability of third-party interface providers to support FAT testing may be limited, interface testing during FAT may be simulated if approved by CTRMA.

FAT shall be conducted in two (2) stages. One stage shall be for lane-level systems (e.g., roadside) and another stage for TFH systems (e.g., reporting, dynamic pricing, and trip building). CTRMA and the CTRMA-designated representatives shall have access to all FAT test sites and data generated during this testing.

CTRMA will observe all ETCS FAT testing. If the TSI fails some portion or all of FAT, and CTRMA desires a retest, then the TSI shall be held accountable for any costs incurred by CTRMA to support and observe the additional FAT event(s).

2.13.3.1 FAT Plan

The TSI shall develop a FAT Plan, including test cases and procedures designed to demonstrate all functionality and requirements of the fully operational ETCS operating in a factory/test environment. The TSI shall submit the FAT Plan and Procedures to CTRMA for review and approval. The FAT Plan shall include descriptions of both roadside and Host FAT and how the two different tests shall be conducted and scheduled, along with a schedule that includes a day by day listing of the different sub-systems, modules, and interfaces to be tested. The FAT Plan and Procedures shall include the requirements to be tested along with the expected results, a description of test data used for functional testing, and a description of the priority levels used for classifying and recording any defects noted during FAT.

2.13.3.2 Host FAT

As per the requirements in the Installation of New Facilities and Transition sections included herein and above, the Host FAT shall be conducted before any roadside installation or testing. Host FAT will demonstrate that all the Host provided systems (e.g., reporting, dynamic pricing, trip building, roadside interfaces, and third-party interfaces) meet requirements. This test can be conducted in a conference room or similar setting, which shall be witnessed by CTRMA or the CTRMA-designated representatives. The DPE may be demonstrated with rates posting to Dynamic Message Signs (DMS) along the roadside, or with a test DMS unit in a factory environment.

2.13.3.3 Roadside Factory Acceptance Testing

The roadside FAT shall be conducted before the transition of any of the legacy roadside systems to the TSI-provided roadside systems. The roadside FAT will demonstrate the full roadside solution with controlled tests. Roadside FATs shall be carried out for each of the facilities just before the TSI begins roadside installations at the facility.

The TSI may conduct roadside FAT at a low-volume plaza on each of the facilities or at the TSI test facility. The TSI shall be responsible for all costs associated with Maintenance of Traffic (MOT), traffic control, and lane closures to carry out a FAT.

If the TSI chooses not to perform roadside FAT at a low-volume plaza on one of the facilities, the TSI shall demonstrate the proposed system at a test facility representative of the installations expected for that facility located within the continental USA. The test site shall accommodate speeds ranging from stop-and-go up to 75 mph.

The purpose of roadside FAT is to ensure that the AVI systems properly frame vehicles (i.e., closely following, stop and go, straddling, weaving in a plaza), that VES cameras are properly triggered and that images are produced and that vehicles are correctly detected and classified. FAT will include testing of DMS unit and CCTV systems for facilities that have those systems.

2.13.3.4 FAT Report and Approval

Following each FAT, the TSI shall submit a FAT report to CTRMA that describes testing results, including all issues/defects found along with the priority level of each. If CTRMA deems the number or effect of unsuccessful tests to be too large or too severe, the TSI may be instructed to resolve defects, rerun the applicable portion of the FAT, or rerun the entire FAT at the sole discretion of CTRMA.

FAT approval is dependent on the successful demonstration of the complete ETCS as functionally compliant with all requirements and meeting the exit criteria identified in the Master Test Plan/FAT Plan.

2.13.4 Site Installation Testing

For each type of site, the TSI shall submit a site-specific installation test plan to CTRMA for review and comment not less than thirty (30) days before the first in-lane site installation. A site installation test shall be conducted at locations where the complete set of hardware, software, and communications equipment is installed. Once the equipment/components have been

individually tested, the subsystems shall be integrated and tested to include communications with the TFH. The site installation tests shall be conducted by the TSI contractor and witnessed by CTRMA per approved test procedures and the test schedule. The TSI shall submit installation test reports, documents, and artifacts showing activities and results to CTRMA for approval.

This test or an approved subset of this test shall be used as a site commissioning test for the remaining sites.

2.13.5 Integration Test

System Integration Testing (SIT) is an end-to-end test to verify that all ETCS components and interfaces meet functional and performance requirements. SIT is to be performed in a production-ready hardware, equipment, network, and connectivity configuration. For any controlled testing during this phase, previous test procedures from FAT can be reused if appropriate and approved by CTRMA.

All third-party interfaces with the TFH shall be demonstrated during a Host SIT and shall be verified to comply with appropriate ICDs. Test cases and test procedures for Host SIT will demonstrate transactions and images, and all other required data can be sent to the DPS with appropriate validation checks, per the ICD for that platform. All data transmission failure cases with failure codes per the ICD shall be demonstrated, and all system-to-system reconciliation processes shall be demonstrated.

Roadside SITs shall be conducted as each of CTRMA's facilities are fully transitioned to the TSI's roadside ETCS. These roadside SITs will demonstrate that the TSI-provided ETCS successfully communicates all roadside transactions, images, and all other data between the roadside ETCS and the TFH. Data validation checks, with appropriate codes and messages, shall be demonstrated during the roadside SITs.

2.13.6 Operational Acceptance Test

The OAT will also be carried out on a facility-by-facility basis. There shall be an OAT once the TFH goes into production, then there shall be roadside OATs as each of the facilities are transitioned to the TSI's roadside system(s). OAT shall be conducted for a thirty-day period which may be consecutive or non-consecutive as approved by CTRMA with the fully implemented ETCS supporting the CTRMA operations staff.

Each OAT will demonstrate all required availability, accuracy, performance, and that the ETCS meets response requirements. An entry criterion to OAT is that the ETCS is meeting or exceeding all functionality requirements as demonstrated during FAT, commissioning, and integration testing, and all SLAs are being met. Two weeks before each OAT, the TSI shall conduct an OAT readiness meeting for the facility going into OAT with CTRMA to walk through OAT entry criteria and the TSI's readiness. During each OAT, the TSI shall demonstrate all SLAs are being met by way of the SLA reporting requirements described in Appendix 7, Service Level Agreement.

CTRMA shall have access to all data sets and reports used by the TSI to demonstrate compliance with the SLAs during OAT. Once the TFH and all facility/roadside OAT is complete

and has been accepted by CTRMA, the TSI shall perform a final OAT with all the transitioned facilities being included with the production TFH.

The TSI is solely responsible for executing OAT and recording the results. However, at its discretion, CTRMA may observe and report defects during OAT.

If any portion of OAT requires repeated restarts due to no fault of CTRMA, the TSI may be held accountable for any costs incurred by CTRMA to support any additional system acceptance testing period(s).

The TSI shall be given full project acceptance and authorization to initiate maintenance invoicing for the ETCS, either a newly installed or transitioned facility, upon the successful completion and the CTRMA approval of the OAT for that project/facility, closure of all punch-list items, completion, and submission of all required documents, including as-builts and updates to manuals and meeting of other conditions as specified in the contract documents. Maintenance invoices shall only include work performed starting from the date CTRMA issues authorization to initiate maintenance invoicing. Work performed prior to authorization to initiate maintenance invoicing is not considered maintenance, even though the project may be open to revenue collection.

For reference, the following diagrams illustrate the transition from the testing to the warranty phases of the project.

The TSI may not invoice CTRMA for maintenance work performed during the OAT phase prior to OAT completion and full project acceptance. The TSI may not recoup additional maintenance costs for maintenance work performed from the time of Go-Live until CTRMA approval to begin maintenance invoicing due to delays in OAT and full project acceptance.

Scenario 1 represents the completion of Operational Acceptance Testing and full project acceptance thirty (30) days after go-live.

1. Operational Acceptance Test and full project acceptance completed thirty (30) days after the start of revenue collection (go-live)
2. Authorization to begin maintenance invoicing May 1
3. First Monthly Maintenance Report (MMR) due May 10
4. First month eligible for maintenance payment is May
5. Warranty period includes the period after go-live (one month) until full project acceptance and the following twelve (12)-month period for a total of thirteen (13) months

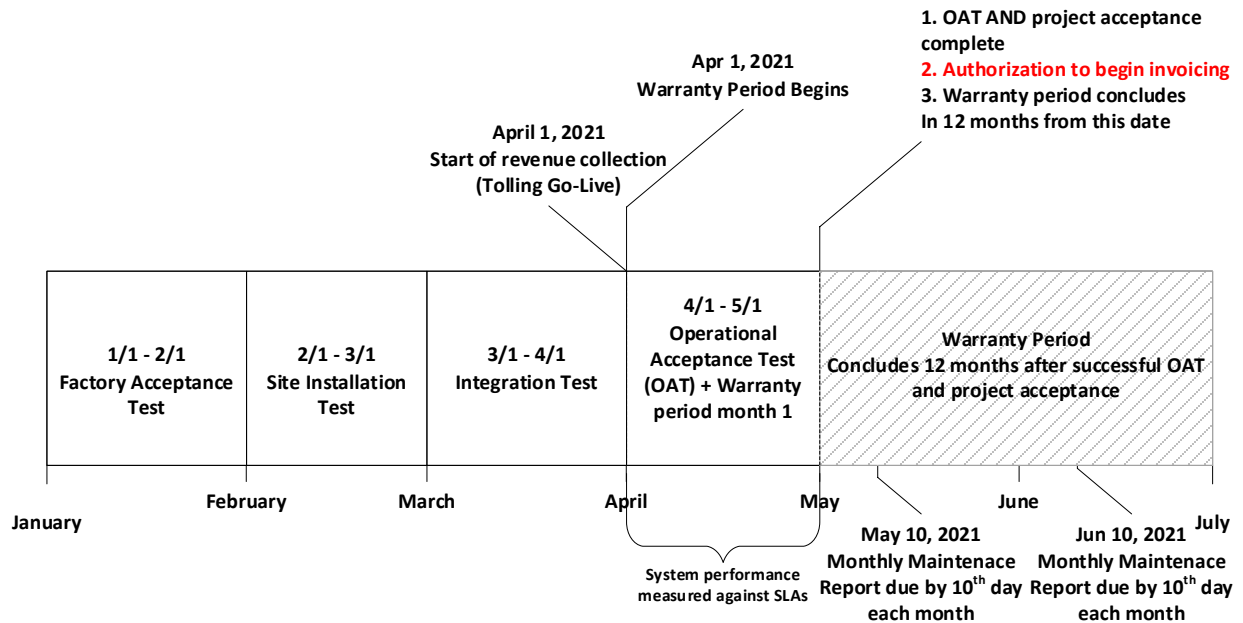


Figure 2-28: Operational Acceptance Test – Scenario 1

Scenario 2

1. Operational Acceptance Test and full project acceptance completed sixty (60) days after start of revenue collection (go-live)
2. Authorization to begin maintenance invoicing June 1
3. First month eligible for maintenance payment is June
4. First Monthly Maintenance Report (MMR) due May 10
5. The warranty period includes the period after go-live (two months) until full project acceptance and the following twelve (12) months for a total of fourteen (14) months.

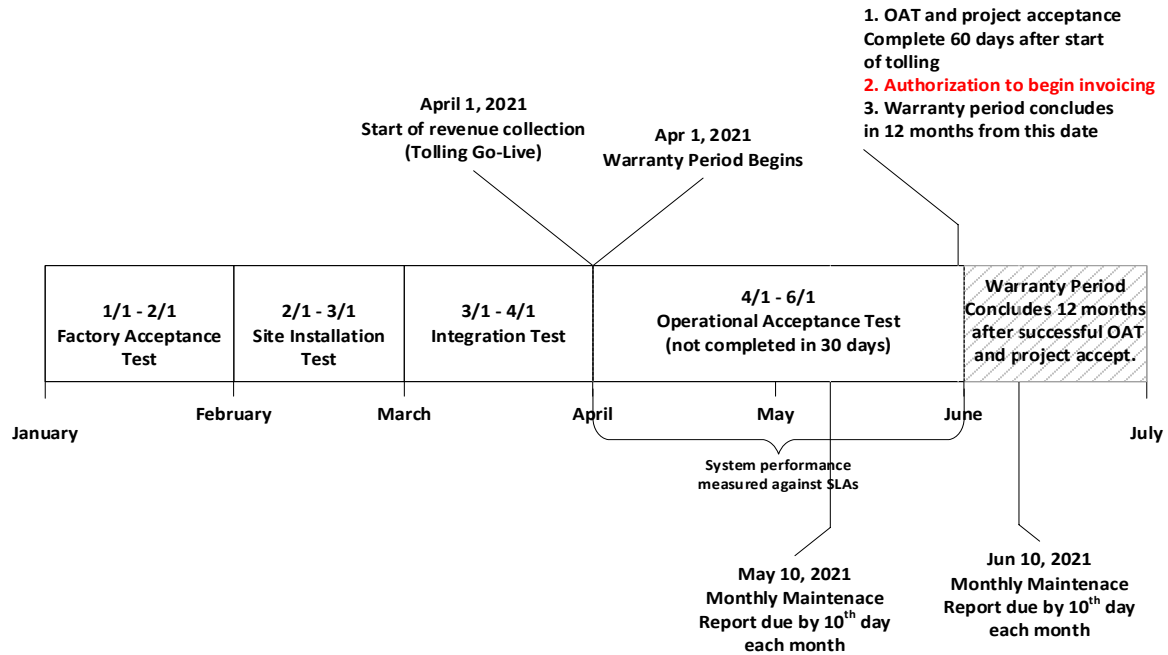


Figure 2-29: Operational Acceptance Test – Scenario 2

Scenario 3 represents the completion of Operational Acceptance Testing sixty (60) days after go-live and a thirty (30) day delay for full project acceptance after completion of the Operational Acceptance Test.

1. Operational Acceptance Test completed sixty (60) days after start of revenue collection (go-live)
2. Full project acceptance completed ninety (90) days after the start of revenue collection (go-live)
3. Authorization to begin maintenance invoicing July 1
4. First month eligible for maintenance payment is July
5. First Monthly Maintenance Report (MMR) due May 10
6. The warranty period includes the period after go-live until full project acceptance (three months) and the following twelve (12)-month period for a total of fifteen (15) months.

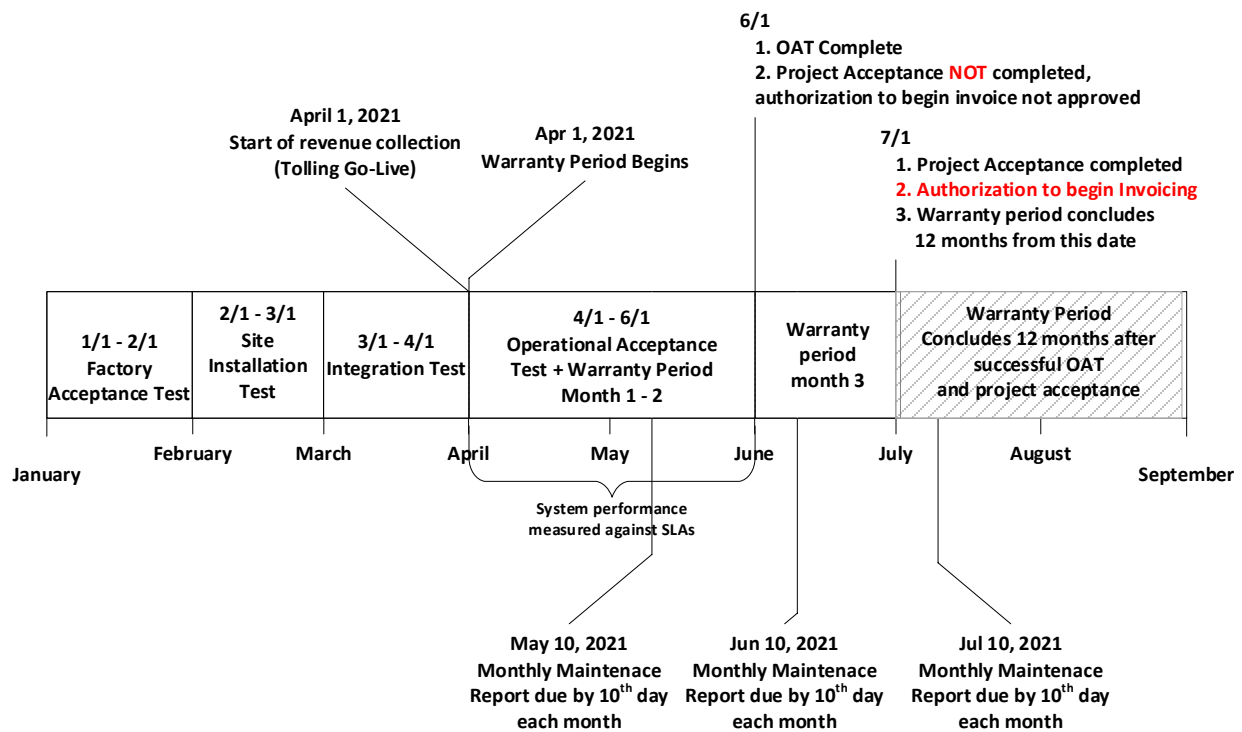


Figure 2-30: Operational Acceptance Test – Scenario 1

2.14 MAINTENANCE

This section provides information regarding maintenance.

2.14.1 General Requirements

The TSI shall provide all necessary maintenance services to support all hardware, software, and network on the ETCS. The TSI shall maintain all Local Area Network (LAN) and Wide Area Network (WAN) network equipment provided by CTRMA and installed and configured by the TSI. The ETCS and associated systems and equipment shall include all hardware and software associated with the following, at a minimum:

1. Electronic Toll Collection System (ETCS) software
2. Zone controllers
3. AVI equipment and subsystems (excluding transponders)
4. AVC equipment and subsystems
5. VES equipment and subsystems
6. Maintenance Online Management System (MOMS)
7. All ETCS network administration, monitoring, equipment, and cables, including the roadside Fiber Optic Network (FON)
8. Roadside equipment cabinets and all associated electronics within the enclosures
9. Roadside security access systems and cameras
10. Equipment mounting and bracket hardware
11. DVAS equipment and systems
12. Express Lane Traffic Sensor (MDS)
13. Express Lane VTMS equipment and system
14. Express Lane CCTV equipment and system
15. Express Lane subsystem hardware and software required for express lane operations, monitoring, trip building, and dynamic pricing functions
16. Workstations, monitors, and printers used by the TSI staff for TIM Center Operations support
17. AC Units/Heaters monitoring and maintenance
18. UPS systems monitoring and maintenance
19. Emergency generators monitoring (note: CTRMA is responsible for generator maintenance)
20. Lane equipment, hardware, and software needed for ongoing development and test support
21. All TFH related servers, equipment, and software

The TSI shall provide maintenance services for the duration of the warranty and maintenance period. These maintenance services include both on-site and off-site services. The TSI shall provide full-time remote help desk support services to assist in troubleshooting and incident/case management for identified software and system issues.

Refer to Appendix 7, Service Level Agreement, for information about the maintenance response and repair times for the warranty and maintenance period.

The TSI shall conduct a bi-weekly maintenance meeting with CTRMA to report operating performance, equipment/system problems, and proposed solutions.

The TSI shall conduct a monthly progress meeting with CTRMA to review the monthly MOMS report, the previous month's work, anticipated work for the next month, and any expected or unexpected operational problems that have arisen. During the monthly progress meetings, the TSI shall identify and communicate to CTRMA all issues affecting the operations or performance of the ETCS. The TSI shall complete root cause analysis and after-action reporting. The TSI shall present how issues arose, were identified, and resolved.

The TSI shall establish and maintain a dedicated maintenance warehouse for this project. The TSI can determine the location of this maintenance warehouse. The location, however, shall allow the TSI to meet the response times outlined in Appendix 7, Service Level Agreement. This warehouse shall serve as the primary location for the storage of any spare parts, consumables, tools, test equipment, repair parts, documentation, and personnel needed to manage and support the ETCS.

The TSI shall provide adequate safeguards against theft, damage, or loss of the CTRMA spare parts in the TSI possession. The TSI shall be responsible for maintaining insurance against loss or damage to the spare parts due to mishandling, improper storage, or theft.

The TSI shall coordinate with the CTRMA operations staff regarding any asset management requests or third-party needs. The TSI shall accommodate unplanned walkthroughs for audit verifications upon request.

The warranty phase shall commence upon go-live (the beginning of revenue collection) and shall include all maintenance and production support for the ETCS. The warranty phase shall conclude after twelve (12) months upon successful completion of the Operational Acceptance Test and full project acceptance of each project/facility, as described in Section 2.13.6 of this RFP. During the warranty period, CTRMA shall receive a full manufacturer's warranty on all hardware equipment. The warranty period shall include all maintenance and production support for the first year of operation. The maintenance period shall begin after completion of the warranty period. The TSI shall ensure that the costs for the warranty and subsequent years of maintenance and production support are separated into individual pricing components in the Pricing Forms in Appendix 6, Price Proposal Forms.

2.14.2 Maintenance Plan

The Maintenance Plan shall include all processes and procedures used to manage, staff successfully, and conduct the ETCS maintenance per the requirements outlined in this RFP. The TSI shall be responsible for maintaining an updated version of the plan for the duration of the project contract. The plan shall address the following, at a minimum:

1. A description of the maintenance methodology and approach
2. Maintenance Team organizational chart and staffing schedules
3. Maintenance regions (if they exist) and staff assignments
4. Specialized tools (if required)
5. A description of MOMS and any other methods used to monitor the ETCS, including priority levels for the response to alarms, dispatching protocol, and sample reports and screens
6. A schedule for the routine maintenance activities the TSI shall perform per the maintenance schedule
7. The maintenance schedule provides information and descriptions of the emergency/corrective, predictive, and preventive maintenance activities for all system components
8. Contracted maintenance relationships. CTRMA must be notified of any TSI-teaming agreements or arrangements to ensure adherence to the project requirements and expectations
9. Maintenance support groups
10. Personnel contact information
11. Staff locations
12. Staff qualifications
13. Description of the staff training
14. Maintenance facilities/workshops
15. Procedures to be used for planning and implementing lane closures
16. Description of maintenance activities executed during peak traffic periods, including how this affects response time and performance of traffic management
17. Software Lifecycle Management
18. Hardware Lifecycle Management
19. Process for responding to force majeure events and repairing damaged systems during the next maintenance window
20. Maintenance record keeping
21. Failure tracking and corrective action
22. Reliability and maintainability analysis and calculations
23. Maintenance activity reports
24. End of project checklist verifying all products provide the current version and include any executed service contracts

This Maintenance Plan shall describe routine, preventive, and corrective maintenance along with maintenance repair procedures and checklists. The Maintenance Plan shall describe how the functionality of MOMS identifies, dispatches, responds, restores, and records an incident or service event. The SLAs specify the maintenance response times, and the plan shall communicate the TSI's processes to meet these response times. The Maintenance Plan shall also address spare parts in inventory management.

The TSI shall update the Maintenance Plan yearly to reflect any new operational practices and newly installed hardware/software that may affect the TSI's maintenance activities.

2.14.3 Monthly Maintenance Report

At the end of the first full month after go-live, the TSI shall submit a Monthly Maintenance Report (MMR) for CTRMA's review. The TSI shall provide one Monthly Maintenance Report, with subsections within that one report for each project/facility. As described in Section 2.13.6, the TSI shall not begin maintenance invoicing until the successful completion of the Operational Acceptance Test and full project acceptance by CTRMA.

The MMR shall include the following, at a minimum:

1. Monthly performance measurements for all defined SLAs
2. TSI calculated monthly liquidated damages (LD)
3. Mean Time to Respond and Repair (MTTRR) calculations, including exceptions and justifications
4. Access to all reports/data used by the TSI in support of the MMR
5. Corrective, preventive, and predictive maintenance activities performed each month
6. Work orders, including the assigned technicians and associated repair times
7. Work plan/scheduled preventive maintenance for the following month
8. Information on the battery health of the UPS equipment
9. Spare parts used/items return to vendors under CTRMA
10. Inventory report

CTRMA must approve format and content before the first submittal.

2.14.4 Maintenance Staffing and Location

As part of the Maintenance Plan, the TSI shall identify the number of remote and local software, hardware, and network maintenance personnel assigned to each job category, including the following:

1. Technical Supervisors (local position)
2. Network and systems engineers (either local or remote position)
3. Database and systems administrators (either local or remote position)
4. Field staff (local position)

2.14.5 Tools, Electronics, and Transportation

The TSI shall provide all necessary and appropriate vehicles to support the ETCS. The vehicles shall contain the necessary equipment, machinery, tools, test equipment, spare parts, repair parts, and consumables necessary to perform all tasks, including overhead work.

The TSI shall be able to accommodate that not all locations have leveling pads for bucket trucks. For future CTRMA projects, provisions for leveling pads shall be made where possible. However, there may be constraints such as drainage that make the installation of a leveling pad at a given location unfeasible.

The TSI shall be responsible for having access to equipment that can overcome the undulation of side slopes and other constraints at locations where leveling pads are not constructed.

The TSI shall ensure that all field staff assigned to any vehicle requiring a special operator's license have the appropriate training and certifications necessary to operate these vehicles.

The TSI shall display their company logo and relevant information on maintenance vehicles assigned to CTRMA support and any vehicle otherwise supporting work at, in route to, and around CTRMA sites, such that they are easily identifiable.

The TSI shall pay tolls for any TSI-operated vehicles traveling on the CTRMA facilities.

2.14.6 Maintenance Methodology and Procedures

This section provides information on the Scope of Work regarding maintenance methodology and procedures.

2.14.6.1 Corrective Maintenance

The TSI shall perform maintenance activities on a priority basis to detect, isolate, and rectify a fault or substantial degradation in the functionality of a system to restore it to its normal operable state. The TSI shall also perform the corrective maintenance based on the third-party audit results or corrective maintenance identified from the Monthly Maintenance Report (MMR).

The TSI shall provide corrective maintenance support on a 24-hour, seven (7) days a week, 365 days per year basis.

The TSI shall prioritize all ETCS maintenance events based on the potential impact on ETCS performance, operations, and the ability to collect revenue.

2.14.6.2 Preventative Maintenance

The TSI shall perform preventive maintenance activities on a scheduled basis (e.g., daily, weekly, monthly, quarterly, and annually) to ensure the maintenance of the ETCS meets the project performance and availability metrics by inspecting, adjusting, cleaning, tuning, and maintaining the ETCS components (e.g., hardware and software) to aid in preventing future failures.

As part of the Maintenance Plan and on an on-going basis, the TSI shall develop a preventive maintenance schedule to be approved by CTRMA, which represents the levels of effort, activities, resources, and schedules required to fulfill the TSI's preventive maintenance responsibilities.

The TSI shall continually evaluate the preventive maintenance schedule based on operational experience gained during the contract, consult routinely with CTRMA with reporting and regular meetings, and submit any recommended changes to CTRMA for approval. CTRMA may request a revised preventive maintenance schedule to ensure that the ETCS components continue to function correctly. The TSI shall schedule the work, as to not interfere with peak travel times.

The TSI shall enter proposed routine and preventive maintenance work activities in MOMS, which shall automatically generate alert/alarm messages and work orders tracked by MOMS.

CTRMA shall preapprove any preventive maintenance that impacts ETCS functionality or CTRMA's customers.

2.14.6.3 Warranty Maintenance

The TSI shall use MOMS to maintain warranty information (e.g., start date, duration, expiration date, responsibilities, and obligations of the parties). MOMS shall generate automated messages when warranties are nearing expiration or when maintenance service relates to a condition of a warranty remaining in effect.

2.14.7 Help Desk

The TSI shall provide help desk staffing during the hours of 7 am to 7 pm, Monday through Friday. The TSI shall provide an after-hours on-call telephone number and email address support for the resolution of issues noted by the CTRMA staff. The help desk shall act as a central point of contact for all technical support, including hardware and software support, installation of updated versions of software, networking, network connection requests, and troubleshooting. The TSI shall provide the ticketing system with appropriate user access for the help desk to log the trouble tickets. All tickets shall be tracked in the ticketing system until resolution.

2.14.8 Spares and Asset Management

The TSI shall purchase and maintain the spare parts and consumables inventory. The TSI shall provide the initial spare parts inventory for the project(s) used during the maintenance phase. This spare inventory shall include spares for new equipment procured by the TSI and spare inventory transferred from ETCS spare inventory. All items in the spare inventory shall have unit prices provided in Appendix 6, Price Proposal Forms, even if the TSI does not need to procure items for the initial spare inventory. If the TSI elects to use the initial spares inventory during warranty, the TSI shall be responsible for funding the replenishment of the inventory levels to their original quantities until the completion of the warranty phase at no additional cost to CTRMA. All spare parts purchased for the project during the maintenance phase (but not including warranty phase) shall be procured by the TSI and expensed on the monthly maintenance invoice. The TSI shall obtain CTRMA's approval before purchasing the needed spares. All spares procured shall become the property of CTRMA and shall be labeled as the CTRMA property and identified with a bar code or other inventory management process approved by CTRMA. The TSI shall use the CTRMA equipment nomenclature when entering spare part information into the spares tracking system(s).

The TSI shall perform a full physical inventory audit annually with a CTRMA representative to verify consistency between the MOMS Inventory Management subsystem and the actual count. The TSI shall also perform a cycle count on each bin or location at least two (2) times per year. MOMS shall have the capability to record the physical inventory, cyclic count details, and update the inventory accordingly with the reason for the difference found in the physical

inventory count. The TSI shall provide a check on all UPS batteries before the start of the project and provide this information within their Inventory Management subsystem.

The TSI shall maintain accurate records of all equipment and parts by location as they enter and leave inventory. The TSI shall apply a unique bar code on all equipment. The TSI shall place the bar code in a readily accessible and uniform area for all similar equipment. The TSI shall provide barcode scanners (three at a minimum) for use by maintenance personnel for direct entry into MOMS of all assets (e.g., operational units, spare inventory, and test equipment). Records shall include part numbers, part descriptions, serial numbers, times and dates of changes to location, warranty information, the CTRMA nomenclature (which includes the CTRMA asset tags associated with the equipment), and a brief description of the part itself. The TSI shall adhere to the following procedures during maintenance activities:

1. When a part requires replacement and is within its warranty period, the TSI shall return the part to the manufacturer
2. When a part requires replacement and is not within its warranty period, the part shall be repaired or replaced (whichever is most cost-effective) and returned to inventory
3. When a part is not repairable or not serviceable, MOMS shall record the part in inventory as retired. The TSI shall coordinate the disposition of retired parts with CTRMA

The TSI shall be responsible for the proper disposal of any parts and equipment removed from service per the CTRMA requirements. The TSI shall obtain approval from CTRMA before the disposal of any parts or equipment owned by CTRMA. The TSI shall coordinate and document any equipment disposals with CTRMA.

CTRMA reserves the right to independently purchase spare parts and transfer to the TSI subject to TSI's inspection and acceptance of the spare parts.

All equipment included in the asset management system shall use CTRMA's nomenclature, provided in Appendix 16, Existing Conditions Report.

2.14.8.1 Spare Hardware

Refer to Appendix 9, Equipment List, for a detailed table that encompasses all existing spares available to the TSI.

Regardless if the TSI elects to re-use any of the existing ETCS equipment, the TSI shall be required to accept all spare equipment owned by CTRMA and residing in the CTRMA warehouse facilities. All the existing and unused ETCS equipment shall be added to the TSI inventory.

CTRMA shall facilitate the transfer of reused equipment with the TSI and supervise the transfer of ownership lists and documents to ensure the transfer of ownership to the TSI. All equipment not being reused shall be subject to the guidelines outlined by the CTRMA equipment disposal policy.

The TSI shall maintain a spare parts/component inventory and adjust stock levels to the most cost-effective, efficient levels. The maintenance force shall keep all parts and components in a

fully serviceable condition ready for immediate installation. The TSI shall thoroughly test spare parts and store them in a serviceable condition to support rapid response time.

The TSI shall use MOMS for inventory control and parts listing.

2.14.9 As-Built Drawings

The TSI shall provide one (1) complete electronic set of as-built drawings for the ETCS in any “native” file format such as MicroStation, Visio, Excel, and one (1) complete electronic set in a PDF format on read-only electronic media.

CTRMA shall review and approve the format of the as-built drawings to ensure they include the required level of detail. The as-built drawing sets shall include the ETCS architecture, all schematics, logic diagrams, layouts, wiring diagrams, assembly drawings, parts detail drawings, and installation drawings. The set of as-built drawings shall consist of a title sheet, an index sheet, and the various as-built drawings. The index sheets shall include a listing of all drawings with headings for Drawing Number, Drawing Title, and the type of drawings, such as assembly, schematic, material list, wiring diagram, wire list, or similar categories.

The TSI shall incorporate and re-submit the as-built drawings for any design modifications, change orders, and field installation changes that occur during the project. CTRMA shall review the as-built drawings for content and shall accept the drawings only when the TSI has complied with the requirements set forth herein.

The TSI shall maintain updated versions of all previously delivered as-built drawing and submit updated as-builts to CTRMA annually, at a minimum, for CTRMA review and approval.

In addition to as-built document submissions and updates reflecting changes made for individual Work Authorizations or change orders, the TSI is responsible to always update and maintain current versions of as-built drawings.

This includes changes made because of routine maintenance or any other field modifications that may occur at any time during the entire warranty and maintenance period.

All as-built drawings shall have received approval before the beginning of OAT. If at any time during the operations of the ETCS, the physical construction or installation becomes modified for any reason, the TSI shall submit updated as-built drawings within two (2) months of completion of the modification. CTRMA shall approve the completion of physical construction or installation on a per facility basis. The TSI shall provide as-built drawings two (2) months after completion of the physical construction and installation at those facilities. CTRMA’s approval of the final system acceptance is a precondition to payment of the OAT completion milestone.

2.14.10 Safety Plan

The TSI shall develop a comprehensive Safety Plan for the project, submitted to CTRMA for review, comment, and approval per Appendix 13, Project Deliverable Schedule. The Safety Plan shall describe the procedures instituted both during system implementation/deployment and during system maintenance activities to ensure personal safety and compliance with all applicable state and federal laws, rules and regulations, and legislation including but not limited

to OSHA, NECA, FHWA, TxDOT, and the MUTCD. The Safety Plan shall also describe steps the TSI takes to ensure health and safety in situations of future pandemics.

The TSI shall ensure the training of personnel working within the facility work areas on the safety program. This training shall occur before the personnel enters any work area. The TSI is responsible for the safety of the TSI's personnel.

The TSI shall update the Safety Plan yearly as part of the Maintenance Plan.

2.14.11 Traffic Control Plan

The Traffic Control Plan shall describe any/all traffic control procedures that shall be instituted both during system implementation/deployment and during system maintenance activities to ensure traffic safety and continued efficient traffic flow. The Traffic Control Plan shall adhere to the traffic control requirements by all local, state, and federal agencies. Any vendor providing traffic control shall be certified and licensed to operate in Texas.

The TSI shall ensure the following, at a minimum:

1. All personnel working within the facility work areas have received training on the Traffic Control Plan
2. The TSI shall update the Traffic Control Plan yearly as part of the Maintenance Plan

The TSI shall implement and maintain the traffic control and sequencing plans throughout the installation, including adjustments to the traffic control and sequencing plans as necessary to assure the safe movement of traffic and pedestrians through the work zone. CTRMA is sensitive to the MOT during peak periods. The TSI will utilize CTRMA's lane closure process.

The TSI shall address all lane-closing procedures in the Maintenance Plan. All closures must be coordinated with CTRMA and CTRMA's operations and maintenance staff so that timely public notification can be achieved. The TSI shall immediately respond to CTRMA for emergency maintenance lane closures, as determined by CTRMA.

The TSI shall provide electronic portable changeable message signs, per TMUTCD and at CTRMA's request of TxDOT Special Specification 6001, as part of the traffic control operations, if addressed in the procedures in the Maintenance Plan. One truck-mounted attenuator is required for all single and double lane closures. Multiple truck-mounted attenuators are required for complete road closures. Truck-mounted attenuators shall be required according to TMUTCD.

2.14.11.1 *Maintenance of Traffic During Installation*

Before any installation, the TSI shall prepare traffic control and sequencing plans for the installation activities being performed. The traffic control and sequencing plans prepared by the TSI must be reviewed and approved by CTRMA before the commencement of any installation.

The TSI shall provide a full-time Traffic Control Coordinator throughout the installation and testing phase of the work. The Traffic Control Coordinator must cooperate with CTRMA and CTRMA's roadway contractor. Revisions to the Traffic Control Plan during implementation must

be developed by the TSI in coordination with the CTRMA Construction Engineer and reviewed and approved by CTRMA.

The TSI shall provide CTRMA with the name of the Traffic Control Coordinator along with a 24-hour phone number where the traffic control coordinator can always be reached.

2.14.11.2 Maintenance of Traffic During Maintenance

Closures for routine maintenance require 72-hour advanced notification and shall be scheduled during minimal traffic periods and coordinated with CTRMA to mitigate interference with the traveling public.

The TSI shall ensure a full-time, off-duty uniformed, certified law enforcement officer(s) in an officially marked vehicle for each lane closure is part of the traffic control operations. Officers must be able to show proof of certification by the Texas Commission on Law Enforcement Officers Standards.

Patrol vehicles must be marked to correspond with the officer's agency and equipped with appropriate lights to identify them as law enforcement. For patrol vehicles not owned by a law enforcement agency, markings shall be retroreflective and legible from 100 feet from both sides and the rear of the vehicle. Lights shall be high intensity and visible from all angles.

2.14.12 Security Plan

The TSI shall provide a Security Plan for the project, submitted to CTRMA for review, comment, and approval. The Security Plan shall describe the general approach the TSI will implement to address security. TSI shall work with CTRMA to determine a data classification process for system data. The Security Plan shall describe personnel, facilities, data, and communications security provisions used for the project(s), including the following, at a minimum:

1. Cabinet, hub, facility, and housing access
2. ETCS software control, including User ID and password protections and system authorization and access control
3. Data privacy
4. Data Confidentiality
5. Data Integrity
6. Data Availability
7. Data communications security
8. Malware and intrusion detection/prevention
9. Incident response
10. Security Awareness Training
11. Responsibilities, rights, and duties of personnel and system users
12. Audit and compliance reporting
13. Tools and processes to be used
14. All applicable SOC security requirements including quarterly user reviews

The TSI shall agree to comply with the Security Plan and applicable policies for the duration of the contract once CTRMA approves the plan.

2.14.13 Change Control

CTRMA's change control process is for any CTRMA system/network changes, which is defined as needed software or hardware updates to the ETCS, and all TSI managed subsystems and communication networks. The change control process does not apply to regular roadside maintenance, where items are being updated/replaced in kind. The change control process shall be managed by the TSI with review and approvals from CTRMA to evaluate Change Request Forms (CRFs) submitted to perform work on CTRMA's ETCS and network. The CRF template shall be developed and managed by the TSI, including an initial review with CTRMA for approval to ensure all key elements of the change control management and decision process are captured as part of the change control process.

The purpose of the change control process is to communicate, vet, and schedule CTRMA system/network changes that could affect the tolling system and the system end-users, including both the internal CTRMA users and toll road customers. The TSI should anticipate CTRMA may require further discussion and consideration of more complex, high risk, and costly change requests. The TSI shall also include the various CTRMA stakeholders from one or several departments such as Finance, Legal, Communications, Operations, Maintenance, and Senior Management. Change requests resulting in additional expenses to CTRMA beyond the base contract amounts may require the CTRMA board approval determined by their dollar value and potential customer or operational impacts. CRF forms for maintenance proposed by the TSI are due the week prior.

Significant proposed changes should be coordinated with the respective impacted SME's before submission of the formal paperwork. The approval of the CRF is meant to be the final check in the process to ensure that the CTRMA operations staff are not impacted unexpectedly. The TSI shall include of summary of all upcoming, approved, and completed change requests with the monthly maintenance report.

2.15 MAINTENANCE ONLINE MANAGEMENT SYSTEM (MOMS)

The TSI shall provide an automated standalone MOMS application that allows for monitoring roadside and TFH equipment, tracking and reporting of work orders, alarm messages, equipment inventory, and equipment health. MOMS shall have the ability to support configurable alarm priorities, as well as maintenance personnel tracking, paging, and work assignments. MOMS shall provide the following, at a minimum:

1. Reporting and tracking alarm/alert messages
2. Notifications to the TSI and the CTRMA staff
3. Logging acknowledgments
4. Generate and track work orders
5. Maintain preventive maintenance schedules
6. Generate repair histories
7. Generate trend analysis
8. Maintain parts inventory

9. ETCS asset management
10. Track system availability
11. Rapid detection of poor performing cameras
12. Lifecycle management and warranty management, including end of warranty dates

MOMS shall function as an integral part of all maintenance activities, including routine preventive, warranty, and corrective maintenance.

2.15.1 MOMS General Technical Requirements

Table 2-54: MOMS General Technical Requirements

ID	RULE
REQ-329	MOMS shall monitor and collect data on the ETCS and equipment status continually 24 hours a day, seven (7) days a week.
REQ-330	MOMS shall support the assignment of maintenance priority levels based on severity level, facility, day, and time.
REQ-331	MOMS shall track Mean Time Between Failures (MTBF) for all ETCS elements.
REQ-332	MOMS shall provide current toll point operational status.
REQ-333	MOMS shall provide current TFH operational status.
REQ-334	MOMS shall provide failure, malfunction, or degradation information by location (e.g., facility and plaza).
REQ-335	MOMS shall provide a general description of the failure, malfunction, or degradation.
REQ-336	MOMS shall support automated spare parts, inventory entry, tracking (usage and reorder points), and control.
REQ-337	MOMS shall provide detailed part and equipment descriptions (e.g., part/model number, serial number, asset tag number, vendor contact information, and the dates the user entered this information into MOMS).
REQ-338	MOMS shall provide part and equipment maintenance activity and repair histories.
REQ-339	MOMS shall automatically generate and track work orders for preventive maintenance, corrective maintenance, and emergency maintenance.
REQ-340	MOMS shall provide historical subsystems, equipment, and component performance information (e.g., availability, mean time between failure, average response time, average restore time, and percent of actual inventory levels to recommended inventory levels for items).
REQ-341	MOMS shall exist as the repository for work orders and logging of maintenance activities initiated without a work order.
REQ-342	MOMS shall support access to stored data using a query by toll zone, hub, or an off-site location, work order status, component, or unique work order number.

ID	RULE
REQ-343	Work order entries shall contain the following types of information, recorded using standardized terminology, and codes where possible: <ol style="list-style-type: none"> 1. Unique work order number 2. Response and restore time, date, location code 3. Model and serial/part number of equipment or software version 4. Status updates with time, date, location, component, and activity records 5. Error and event codes associated with the incident or failure event 6. Description of work performed (e.g., corrective actions, reconfiguration) and services rendered (e.g., warranty service) 7. Name of the maintenance technician(s) who performed the work 8. Disposition of the hardware and equipment problem (e.g., repaired, replaced, or returned to supplier/manufacturer) 9. Work order closure pending specific follow-up actions (e.g., root cause analysis)
REQ-344	MOMS shall track hardware, equipment components, software failures, and malfunctions by equipment type and ID number. MOMS shall track component failure rates (e.g., failures/operating hours) or MTBF continuously.
REQ-345	MOMS shall generate monthly reports showing measured average failure rates and manufacturer advertised or claimed MTBF (as applicable).
REQ-346	Access to MOMS information shall require the entry of the user’s identification and password from which the subsystem shall retrieve the user’s assigned role(s).
REQ-347	User sign-on, access, and access failures, both local and remote, to any element of the toll systems shall be recorded and tracked for security audit purposes and reported to MOMS. The system shall continuously and automatically monitor for unauthorized access; access violations shall be reported to MOMS as a Priority 1 alert. These reports shall be provided to CTRMA within one (1) hour of discovery.
REQ-348	MOMS shall not allow any user to append the timestamp of an event, including the initial acknowledgment time, response time, and repair times entered by a maintenance staff member without express permission by CTRMA.
REQ-349	If CTRMA provides permission, the appending of the timestamp of an event must include the following: <ol style="list-style-type: none"> 1. Who performed the update 2. When the update occurred 3. What information was updated 4. Why the update was needed

2.15.2 Equipment Status Monitoring and Diagnostics

Table 2-55: Equipment Status Monitoring Technical Requirements

ID	RULE
REQ-350	MOMS shall report the status and diagnostic results of all equipment in near real-time.
REQ-351	Performance monitoring functionality shall allow the user to select and observe the status and performance of several pre-defined portions of the system.
REQ-352	MOMS shall contain the functionality to generate alerts, alarms, and notifications, as well as the ability to send this information to a configurable group of recipients.

ID	RULE
REQ-353	Data from the alerts, logs, hardware and software status, work orders, tickets, and any items in the IT Service Management/MOMS shall not be deleted or modified at any time.
REQ-354	A Single Network Management Protocol shall support the monitored equipment. The TSI shall build routines to measure instances of an undesirable state and generate an alarm when an established and configurable threshold is reached.
REQ-355	MOMS shall be capable of identifying state changes requiring the automatic generation of work orders and shall dispatch a technician on a schedule consistent with the severity of the state change and the assigned priority level.

2.15.3 Work Order Generation

Table 2-56: Work Order Generation Technical Requirements

ID	RULE
REQ-356	MOMS shall automate the process of expediting repair/service calls to field maintenance staff. MOMS shall contain the functionality to generate work orders with little or no human intervention.
REQ-357	The TSI staff shall have the ability to create work orders manually, enter data regarding maintenance statuses, search work orders based on component or subsystem failures, and close work orders.
REQ-358	<p>Work order generation shall include the following:</p> <ol style="list-style-type: none"> 1. Generate a minimum of three different work order priorities as defined by CTRMA. 2. Capability to build ad-hoc work orders for unusual system occurrences. 3. Provide formats and specifications as determined by CTRMA. Work orders shall include the following information regardless of the final format: <ol style="list-style-type: none"> a. The date and time of the work order generation b. The date, time, and location of the repair or maintenance call c. The work order number (sequential) d. A description of the failure or malfunction 4. MOMS shall contain a work order field for failure or malfunction descriptions. 5. MOMS shall provide a drop-down field for standardized descriptions (approved by CTRMA) for the field designated failure or malfunction descriptions. This drop-down field shall contain searchable functionality. 6. MOMS shall allow the user to schedule one-time or recurring preventive maintenance tasks for a specified duration(s).

2.15.4 Technician Dispatch

Table 2-57: Technician Dispatch Technical Requirements

ID	RULE
REQ-359	MOMS shall contain the functionality to automatically dispatch in real-time the required support personnel to restore a failed, malfunctioning, or degraded equipment or component item.
REQ-360	Depending on the severity of the problem or issue, MOMS shall assign a priority level. MOMS shall contain the functionality to include the corresponding priority level value to the work order record.

2.15.5 Work Order Tracking

Table 2-58: Work Order Tracking Technical Requirements

ID	RULE
REQ-361	MOMS shall provide the capability for tracking the status of the generated, processed, and closed work orders. This functionality shall be part of the MOMS dashboard or separate work order management functionality.
REQ-362	MOMS shall have the ability to determine and calculate initial acknowledgment times, response times (both remote and on-site), repair times, and lane and system downtime.
REQ-363	MOMS shall have the ability to search by and sort on corrective actions taken by the TSI staff to resolve the failure or malfunction.
REQ-364	The TSI shall not place any MOMS pages into a hold queue unless CTRMA approves, or lane closures are required to service the failed device.

2.15.6 Dispatch Escalation

Table 2-59: Dispatch Escalation Technical Requirements

ID	RULE
REQ-365	MOMS shall contain functionality to escalate a work order not acknowledged by the appropriate technician within a configurable time of the initial notification.
REQ-366	MOMS shall support building and reading an escalation order that uses a table containing the IDs of support staff and supervisors.
REQ-367	This escalation functionality shall occur should MOMS not receive a notification response for any event.

2.15.7 Information Entry and Closeout

Table 2-60: Information Entry and Closeout Technical Requirements

ID	RULE
REQ-368	MOMS shall support the functionality for a technician to enter their actual arrival time and time of work completion.
REQ-369	MOMS shall support the functionality for a technician to enter this information at the site of the maintenance issue, or remotely.

ID	RULE
REQ-370	After the technician performs the work, MOMS shall update the status of the work order along with information entered by the technician describing the event, work performed, and materials used.
REQ-371	The work order generation functionality shall integrate with the spare parts inventory control functionality. MOMS shall automatically update the spare parts inventory based on the technician’s entry of asset coded parts used to restore defective items.
REQ-372	MOMS shall allow the assigned and responding technician to close out the work order when the subsystem receives a status change. This status change shall indicate the restoring of the defective item.

2.15.8 Scheduled Services (Manufacturer’s Warranties)

Table 2-61: Scheduled Services (Manufacturer’s Warranties) Technical Requirements

ID	RULE
REQ-373	MOMS shall use and adhere to manufacturers’ required maintenance activities and intervals to comply with warranty maintenance requirements so that manufacturer warranties remain valid.
REQ-374	MOMS shall issue an alert at a configurable number of days before the expiration of any warranty period entered.

2.15.9 Spare Parts Inventory Control System

Table 2-62: Spare Parts Inventory Control System Technical Requirements

ID	RULE
REQ-375	MOMS shall include an automated spare parts inventory control system for entering, tracking, and controlling the movement of spare parts used to maintain the ETCS.
REQ-376	The MOMS GUI shall support the entry of each equipment item, device, part, and component.
REQ-377	Entered information shall include part/model number, serial number, primary vendor contact information, subcontracted vendor contact information, last invoice price for the item, last order lead time (e.g., order to delivery), and the date the user entered the information into the system.
REQ-378	The management of spare parts inventory within MOMS shall integrate with the work order process to track the usage of spare parts.
REQ-379	The MOMS Inventory Management subsystem shall work in conjunction with the GUI entries to remove spare parts from inventory.
REQ-380	MOMS shall contain the functionality to calculate and track the current value of the spare parts inventory.
REQ-381	MOMS shall record and track all repair activities, and the details of the repair and the disposition of the part, including parts retired.
REQ-382	The TSI shall provide a safe and secure storage location for all spares and shall bear all risk for loss or damage.
REQ-383	MOMS shall have the option to move or transfer asset items between locations and the TSI maintenance staff.

ID	RULE
REQ-384	MOMS shall track the complete chain of custody for each inventory item from initial purchase to storage at the TSI facility, to dispensing inventory to staff, to installation in the field, operation, removal, and final disposal.
REQ-385	The MOMS Inventory Management subsystem shall automatically generate alerts when asset inventory reaches a configurable threshold.
REQ-386	MOMS shall contain the functionality to collect and analyze the ETCS component usage data to generate forecasted parts and replacement cycles, as well as forecasted purchases for the succeeding eighteen (18) months. MOMS shall also contain functionality to maintain vendor lists for any of the ETCS assets.

2.15.10 MOMS Reporting

Table 2-63: MOMS Reporting Technical Requirements

ID	RULE
REQ-387	MOMS reporting system shall support the generation of reports in PDF, CSV, and other formats specified.
REQ-388	MOMS shall provide CTRMA read-only access to this subsystem to perform such functions as generating reports, reviewing details of open work orders, investigating current hardware, equipment, and device locations, and reviewing spare parts inventory levels.

2.16 TRAFFIC MANAGEMENT CENTER STAFFING

As part of CTRMA’s long term operations and staffing strategy, CTRMA is considering hiring all or some required TIM Center staff and assuming all full or partial responsibility for TIM Center staffing and operations. A final decision requires CTRMA’s board approval and is not expected to take place until mid-2022, with a transition from the TSI to the CTRMA staff to occur in mid-2023.

Until CTRMA reaches a decision resulting in CTRMA assuming TIM Center staffing responsibilities, the TSI is responsible for all TIM Center staffing needs.

The TSI shall employ, train, supervise, and schedule the required staff to support CTRMA’s TIM Center operations, including, but not limited to, the following duties:

1. Provide coordinated monitoring of incidents with CTRMA and partner agencies.
2. Answer phone inquiries and coordinate incident-related activities with partner agencies to share information related to traffic conditions.
3. Provide monitoring of all equipment and systems, including the TSI-provided ELCC, required to support the express lanes and dynamic pricing system, including traffic control device operation and variable message signs.
4. Operate CTRMA’s third-party Advanced Traffic Management System (ATMS) software interface to field devices and equipment from the TIM Center for traffic management.
5. Create and post messages for the Dynamic Message Signs (DMS).
6. View traffic conditions on Closed Circuit Television (CCTV).

7. Monitor traffic status, special events, scheduled events, active events, and incident fault status by utilizing CCTV cameras, emergency response, law enforcement reports, and internal systems.
8. Communicate with emergency services such as state and local police, emergency communications centers, emergency response/motorist assist, maintenance departments, and media outlets.
9. Facilitate incident management, which includes detection, verification, response, and clearance.
10. Dispatch emergency response personnel in response to incidents.
11. Monitor all active traffic events that occur during the shift and ensure that the information is accurately recorded into systems and traffic-related messages.
12. Troubleshoot and resolve system-related problems.
13. Coordinate with another TSI and the CTRMA staff with regards to various agencies and general control room coordination, especially at shift change.
14. Assist with the data collection for various reports, travel speed and travel time reports, incident reports, field equipment failures, and any other reports that are required for the operation of the TIM Center.
15. Perform related duties as directed by the CTRMA Traffic and Incident Manager.
16. Provide adequate staff and resources for all tasks and activities throughout the duration of the contract, including planned and unplanned staff absences, emergencies, storms and other significant events.
17. Employ, train, supervise, and schedule ELCC operators. These activities shall include accommodating vacations, sick leave, and other absences of personnel by providing adequate training and supervision of relief operators and on-call personnel.
18. Issue work orders for equipment repair and help establish priorities for the repair of failed equipment.
19. Attend regular meetings with CTRMA to cooperatively identify and prioritize work to be performed.
20. Maintain records and documentation as directed to support the overall operations of the TIM Center and provide data for documenting performance measures and progress.
21. Participate in post-incident debriefings with all appropriate agencies involved in managing major traffic incidents to determine whether existing operating procedures should be changed. The TSI personnel assigned to this task shall be available to respond to electronic notifications within one hour during off-duty hours to help as appropriate.
22. Prepare and submit monthly invoices and progress reports per the applicable CTRMA requirements. Clerical/Administrative support staff will prepare the TSI invoices, reports, forms, letters, and any other official project-related correspondences, as well as the hiring of staff and or other personnel-related duties. The Clerical/ Administrative support staff are not expected to have TIM Center-related activities as a full-time task, nor are they to be based at the TIM Center.
23. The TSI shall provide staffing during peak periods, on holiday weekends, special events, and/or emergency conditions where CTRMA may require greater levels of staffing. If

CTRMA deems additional TSI personnel are necessary to operate the expanded functions of the MoPac project, the TSI shall supply extra staff for the short-term, provided a minimum of four-hour notice is given.

24. In no event shall the TSI operator leave the TIM Center unstaffed during an emergency, active event, or incident, even at the end of a shift. If CTRMA determines the additional TIM Center staff shall be a permanent position requirement, the staffing level shall be adjusted via supplemental agreement. Additional pricing estimates shall be provided upon request.
25. The TSI shall provide staffing to operate the TIM Center during peak hours and in operation from 5:30 am to 8:00 pm Central Standard Time (CST), five days a week excluding holidays per CTRMA's approved holiday schedule.

2.17 NETWORK ADMINISTRATION

The CTRMA Fiber Optic Networks (FON) at each facility are private telecommunication network infrastructures. There are two typical configurations currently in use. One consists of Gigabit and Fast Ethernet equipment operating in a ring and a point-to-point (P2P) configuration over a CTRMA-owned fiber optic cable plant. The other configuration consists of a Gigabit Fiber network operating along a single path. Network infrastructure and configurations for each facility are similar but not identical. Diagrams and as-builts for each of the existing facilities are available to bidders through the ETCS video recording and the Appendix 16, Existing Conditions Report.

The FON serves CTRMA's immediate and long-term telecommunications needs for data and video transmission, supporting present and the future ETCS and ITS. The FON provides for all CTRMA's data communication needs concerning the operation of the Legacy ETCS.

The FON is composed of two distinct elements. The first element is the fiber optic cable and conduit plant, referred to as FON outside plant (OSP). The second element is the networking hardware, referred to as FON inside plant (ISP). The FON OSP includes, without limitation, buried single-mode fiber cable installed in the HDPE conduit. For each existing facility, the FON OSP provides a single ring network backbone. The FON ISP includes, without limitation, Layer 3 Gigabit Ethernet Core switches, Layer 3 Gigabit Ethernet Aggregation switches, Layer 3 Gigabit Ethernet Edge switches, Layer 2 Gigabit Ethernet Edge switches, channel banks, and firewalls. Each facility has a Wrong Way Detection (WWD) system, which, in some instances, may interconnect with the toll system at the layer 3 switch level. The TSI will not be responsible for the WWD system communications.

For each new facility, the TSI is responsible for the installations of all necessary communication equipment, connections, configurations, testing, monitoring, and network administration as it relates to the LAN and WAN. The TSI shall develop network designs in coordination with CTRMA and the civil contractor.

For the transition of existing facilities, the TSI is responsible for all communications equipment, connections, configurations, testing, monitoring, and network administration as it relates to the LAN and WAN necessary to support the transitioned ETCS. The TSI may reuse existing

equipment or install new equipment, as necessary. The TSI shall coordinate the transition of network administration and maintenance responsibilities with the existing TSI and CTRMA as part of the transition of the entire facility, which shall include identification of demarcation points where possible.

All work performed by the TSI shall conform to the latest edition of all codes, standards, and specifications listed below:

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. Building Officials and Code Administrators, Inc. (BOCA)
4. Computer and Business Equipment Manufacturers Association (CBEMA)
5. Electrical Testing Laboratories (ETL)
6. Illuminating Engineers Society (IES)
7. Institute of Electrical and Electronics Engineers (IEEE)
8. Insulated Cable Engineers Association (ICEA)
9. National Fire Protection Association (NFPA)
10. National Electrical Safety Code (ANSI/IEEE C2)
11. National Electrical Manufacturers Association (NEMA)
12. Underwriters Laboratories, Inc. (UL)
13. National Electrical Contractors Associations (NECA) - National Electrical Installation Standards (NEIS)
14. Electronic Industries Association (EIA) Standards for Interfaces and Interconnection or Electronics
15. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual
16. Telecommunications Industry Association (TIA)
17. Organization for the Advancement of Structured Information Standards (OASIS)

The civil contractor will provide, terminate, and test the fiber connections from each toll equipment location (the Metro Area Network or MAN). The TSI is responsible for all elements of the LAN. The TSI is responsible for all internet circuits connecting the toll system network(s) to the internet cloud.

The TSI shall coordinate with CTRMA and the civil contractor regarding demarcation points between the onsite fiber network and Internet Service Providers (ISPs). The TSI shall coordinate with CTRMA and the civil contractor regarding overall network design and splicing for the MAN physical network between the toll locations. Once network design is finalized, the TSI shall certify in writing that the network design meets all contract performance requirements.

The TSI shall be responsible for the maintenance of the entire CTRMA communications network installed on the project(s). Network maintenance activities shall include the monitoring of the primary and backup networks transmitting data between the roadside equipment, the Facility Host location(s), and the CTRMA BOS. The TSI shall monitor the connections with all external interfaces at the TOC(s) and Facility Host, such as to the BOS and commercial leased lines.

The TSI shall be responsible for the protection of the FON outside plant (OSP) including utility locate services and utility coordination with internal and external stakeholders. TSI must comply with applicable laws, all federal, state, and local laws, statutes, ordinances, codes, rules, regulations, guidelines, and industry practices and methods including locating procedures adopted and approved by the National Utility Locating Contractor’s Association (NUCLA) and the State of Texas and include necessary records to research and respond to field investigations to determine the facilities’ locations.

The TSI will coordinate with CTRMA for the development, implementation, and administration of warranty/service support contracts with network equipment manufacturers for all network hardware. Support contracts shall provide for repair/replacement of the CTRMA identified “critical” components within 24 hours of equipment failure.

The TSI shall maintain warranty records and service agreements for all network hardware.

Table 2-64: Network Administration Technical Requirements

ID	RULE
REQ-389	The TSI shall design, integrate, purchase new or re-use current equipment, furnish and install all network elements attached to the toll system side of each network demarcation point needed to protect, operate and maintain the toll system in accordance with the requirements of this contract. All such network elements shall be part of the Toll System.
REQ-390	The TSI shall not furnish any item that has been previously used for development work, a part of a previously purchased system, or any items that have been salvaged or rebuilt.
REQ-391	The TSI will provide warranty and service support contract for all existing network equipment that will be re-used for the term of the contract. Any network equipment which reaches “End of Life” and is no longer supported by the manufacturer will be replaced at the TSI’s cost.
REQ-392	All new network equipment and related operating systems shall be supported with patches, hotfixes, and updates from the manufacturer for a minimum of ten (10) years after installation.
REQ-393	The TSI shall implement the toll system network(s) using industry-standard best practices for securing all interfaces and communications between network elements, including but not limited to multi-factor authentication, virtual private networks, strong passwords, encryption, and intrusion detection/prevention.
REQ-394	The toll system network(s) shall comply with industry-standard best practices for accessing the network(s) from remote locations, including but not limited to multi-factor authentication, virtual private networks, and strong encryption.
REQ-395	The toll system network(s) shall limit access to configurations, operations, and controls to authorized personnel. Multi-factor authentication methods shall control such access.
REQ-396	During design and construction, the TSI shall provide review and comment of civil contractor shop drawings or similar within the context of the toll system network(s) functional and performance requirements.

ID	RULE
REQ-397	Upon approval of shop drawings or similar design elements by the civil contractor within the context of system function and performance, the TSI shall assume responsibility for those elements. If the civil work is installed as designed and does not meet the performance requirements of this contract, the TSI shall be responsible for the costs of the redesign, civil rework, and additional equipment costs as further outlined in the contract.
REQ-398	The TSI shall review and provide comments on all aspects of plaza design drawings submitted by the civil contractor that is related to the toll system network(s) equipment required to meet the requirements of this contract.
REQ-399	All interfaces that utilize the Internet for communication shall implement a firewall for added security. The firewall configuration shall be submitted to CTRMA for review and approval prior to implementation.
REQ-400	All applicable toll system elements shall be Federal Communication Commission (FCC) licensed and approved.
REQ-401	All elements of the toll system shall not be susceptible to electromagnetic emissions from other equipment operated at department facilities, including but not limited to police two-way radios, citizens' band radios, other radio systems allowed or licensed by the FCC, mobile telephones, security Equipment, roadside lighting, and other electrically powered items.
REQ-402	The TSI shall enter or update all details of each network equipment element into MOMS immediately after installing such an element.
REQ-403	If communications to any of the ETCS are down, an alarm shall be generated and reported to MOMS.
REQ-404	The TSI shall provide an industry-standard network monitoring tool such as SolarWinds to monitor all network equipment actively and provide notification of any network issues. This monitoring tool shall be separate from MOMS but shall interact with MOMS such that MOMS creates and maintains trouble ticket/problem resolutions for the system.
REQ-405	Prior to installing each unit of network equipment, the TSI shall apply all updates, patches, and firmware changes provided by the manufacturer. Critical updates will be tested and installed within thirty (30) days of release. All applicable updates will be reviewed to determine if they are necessary and, if so, will be tested and installed within ninety (90) days of release.
REQ-406	Remote access to all systems shall be VPN based and controlled through an industry-standard Identification and Access Management (IAM) system to ensure the systems meet all state and the CTRMA information security guidelines, with each user having a unique log-in and requiring multi-factor authentication (i.e., Access Control).
REQ-407	CTRMA envisions implementing various pilot programs for new transportation technologies as part of its toll road projects. For new toll facilities, and as part of the network design involved in refreshing the network equipment for current toll facilities, the TSI shall install adequate fiber, cabling, conduit, and bandwidth such that 25% can be reserved to be used by other technology vendors designated by CTRMA. The TSI shall be responsible for network administration of the entire network and will provide configuration and set up assistance to new technology vendors.

The following table defines cloud-based security, data management, and disaster recovery requirements only if the TSI implements a cloud-based infrastructure in support of the TFH or any TFH or ETCS subcomponents.

Table 2-65: Off-Premise (Cloud-based) Technical Requirements (if applicable)

ID	RULE
REQ-408	The physical location of all systems housing data related to the CTRMA ETCS shall be within the 48 contiguous US states and shall be in a Tier 2 or higher facility.
REQ-409	The TSI shall ensure that no PII or PCI related data is stored on storage devices shared with other cloud provider customers.
REQ-410	All purging of data shall be done through cryptographic erasure.
REQ-411	The TSI shall implement encryption of data at the roadside system level and ensure all data is encrypted prior to transit.
REQ-412	The TSI shall control all encryption keys. The cloud provider shall not control any data encryption keys.
REQ-413	Contracts, licensing, agreements, and the SLAs between the TSI and the cloud provider shall be provided to CTRMA for review.
REQ-414	The TSI shall insure through the contract, agreement, or licensing that all data within the TFH system is owned in totality by CTRMA, and the cloud provider shall provide access to the TFH systems and data at any time at CTRMA’s request. This access shall not require approval by the TSI. Alternatively, the TSI can provide admin access to the data storage.
REQ-415	The TSI shall insure through the contract, agreement, or licensing that all data will be accessible for export by the TSI or CTRMA on request. Alternatively, the TSI can provide admin access to the data storage.
REQ-416	The TSI shall provide an information security audit report for the cloud provider to CTRMA for review and approval prior to the TSI contracting with a public cloud provider.
REQ-417	<p>REQ-417A: The TSI shall document their approach to disaster recovery, incident response, and business continuity related to the cloud-based services for CTRMA for review and approval. These concepts shall be addressed in the TSI’s Disaster Recovery and/or Security Plan as appropriate.</p> <p>REQ-418B: The TSI shall conduct a walk-thru test of the incident response process semi-annually and separately from any disaster recovery or business continuity testing.</p>
REQ-418	The TSI shall address information security specific to security issues with the use of the cloud infrastructure within the TSI’s Security Plan.
REQ-419	If the TSI is implementing “on-demand self-service provisioning” for its cloud infrastructure, the TSI shall conduct a weekly audit of its cloud services to ensure no unauthorized usage of services has occurred.
REQ-420	At least one copy of all system and data backups shall not be stored within the same cloud provider region as the TFH itself.
REQ-421	All connections to the TFH and the cloud management controls and consoles, and user interfaces shall be made through secured connections using multi-factor authentication. IP Enabled lockdown shall be implemented where appropriate.

2.18 SUCCESSION PLANNING

The TSI shall be responsible for services in support of transitioning the responsibilities of the TSI under this contract to CTRMA and/or another entity whenever this contract terminates. The TSI shall be responsible for the following activities in support of succession:

1. The proposed approach to support the transition to a successor ETCS at the conclusion of the contract.
2. Update all ETCS documentation to include any previously undocumented changes, additions, alterations, and configurations for delivery to CTRMA and any succeeding entity, including the following:
 - a. Detailed Design Document
 - b. Detailed Reports Document
 - c. Business Rules
 - d. Data Dictionaries
 - e. As-Built Drawings
3. Provide all service contracts, agreements, licenses, manuals, Standard Operating Procedures, correspondence, outstanding invoices, manuals, and training materials to CTRMA and any succeeding entity
4. Provide equipment maintenance history
5. Provide spare parts inventory and history
6. Participate in meetings to plan for the transition of the data to another system
7. Participate in testing of migration procedures and applications
8. Provide any technical data requested by CTRMA or any succeeding entity

The TSI shall prepare and submit a Succession Plan to CTRMA. The Succession Plan shall include the following, at a minimum:

1. Provide information and a schedule for the transition of the system
2. Define the personnel, roles, and responsibilities to maintain and execute the plan
3. Define the processes, activities, and controls required
4. Provide for an orderly transition of all components comprising the TSI ETCS from the incumbent TSI to the incoming TSI
5. A list of the TSI maintained facilities including redundant power requirements, UPS configuration, generation, power lines and distribution, environmental control and monitoring systems, fire protection and access controls, rack layouts, wiring, and network
6. Details of the TSI-provided hardware, including open tickets related to incidents with any vendor, storage capacity (e.g., total, used, and available), performance metrics, and planned improvements. Also, the TSI shall provide a catalog of all documents, equipment, and technical data discussed in this section of the RFP, at a minimum.
7. A description of what procedures shall be necessary to prepare and transfer all data and documentation to CTRMA or a succeeding entity

8. A proposed schedule for the succession activities necessary for an efficient, accurate, and complete transition to a succeeding entity.

The Succession Plan shall support a 120-day succession period to transition operations from the incumbent TSI to the incoming TSI. During this 120-day period the TSI must provide continued Services and transition support to ensure that there is business continuity and no negative effects to customers and customer service during the transition.

The initial Succession Plan shall be submitted upon commencement of the maintenance phase with the transition of the first facility as defined in Phase I. The TSI shall update the Succession Plan with the transition of each additional facility and implementation of each new facility within ninety (90) days of the commencement of the maintenance phase for each subsequent Work Authorization. The updated Succession Plan shall address changes and/or new components implemented with each facility. In addition to updates associated with each Work Authorization, the TSI shall update the Succession Plan annually, to reflect any other changes resulting from maintenance, configuration, or upgrades that may impact any aspect of the Succession Plan. All updates to the Succession Plan shall be submitted to CTRMA for review and approval. The TSI shall be responsible for supporting the transition to the successor system, without additional cost, at the end of the contract.

2.19 MANUALS

The following sections provide information regarding reports and system user manuals.

2.19.1 Reports Manual

The TSI shall provide a Reports Manual that includes all available reports. The Reports Manual shall include the following, at a minimum:

1. Name of the report
2. Report description
3. Version number
4. Identification of report field level reconciliation (i.e., which fields in one report can be reconciled to another)
5. Data element dictionary that provides field definitions and defines each data element in the report to be updated and maintained by the TSI as reports may be modified over time. With any new release of a report, the corresponding data dictionary must be updated and provided for approval to CTRMA along with the report
6. Latest date of any revision
7. Sample report
8. SQL queries (or similar construct)

The reporting system shall generate, display, export, and store reports as per the following requirements:

1. Report generation screens shall be standardized such that layout, entry fields, buttons, search functionality, and similar features are the same across all reports.
2. Multiple tabs shall be avoided.
3. Date and time entry fields shall have a feature that allows for the quick entry of values appropriate and typical to the given report. For example, the date and time entry fields have a button or link that completes the From Date/Time entry fields from the beginning of the current day, and the To Date/Time entry fields with the end of the current day.
4. Standard reports shall be scheduled to be generated automatically on a user-defined frequency/time or by user demand.
5. User access to reports based on pre-defined, configurable user categories.
6. Summary and detail level reports shall allow the user to drill down from summarized data fields to obtain the detailed underlying data.
7. Standardized report format with headers and footers on all pages that contain the following:
 - a. CTRMA logo
 - b. Report title
 - c. Selection criteria used to generate the report
 - d. Date and time when the report was generated
 - e. Username
 - f. Indicator of whether the report contains adjustment data
 - g. Page number and the total number of pages contained in the report
 - h. Subtotals
 - i. Print sizes ranging from letter-size to tabloid-size paper
8. Column and row titles labeled using terms that are clearly defined in user documentation and applied consistently throughout all reports.
9. An unlimited number of columns to display the necessary data. Reports that are intended to be printed shall be approved by CTRMA for columns, look and feel.
10. Segregation of relevant data by facility/segment.
11. Selection of one or more specific facilities and segments.
12. Range of output options including PDF, CSV, Excel 2016 (or later), and screen display.
13. Full reconciliation, whereas detail level reports support summary level reports and data points (numbers) reconcile between them.
14. The transaction and revenue reports shall be available by the facility/segment.
15. All reports shall adhere to the report performance KPI's.

Hourly, daily, weekly, monthly, and yearly transaction and revenue shall be available by location (facility, plaza) and presented in row/column format as well as in graphical and/or chart format.

The TSI shall develop and submit a Reports User Manual for review, comment, and approval by CTRMA. This manual shall detail each report delivered to CTRMA, including report name, column headings, report parameters, and details for expected data in each column/row.

2.19.2 System User Manuals

The TSI shall provide a set of system user manuals designed to provide the intended users with the information necessary to perform their work as it relates to the proposed system. All manuals provide a logical system-oriented organization and content that incorporates a full range of diagrams, illustrations, graphics, screenshots, tables, and instructions required to perform supported system functions. Manuals shall be provided in electronic format. As a guiding principle for the development of the ETCS user manuals, all necessary documentation shall be provided to allow a third party to maintain, configure, and test any proposed customized components of the system. The TSI shall keep all user manuals current for the duration of the contract, as described in Section 2.7.6.5, Online Document Sharing and Document Management System.

The TSI shall develop and submit the ETCS User Manual for CTRMA to review, comment, and approval. This manual shall cover all aspects of each subsystem functionality accessible by a GUI, including authentication, screen navigation, menu items, and descriptions, drill-down capability and description, graphics capability, report generation, and maintenance features. Instructions and guidelines for power-up and shut-down, configuration settings, online component replacement, system administration tasks including back-up, recovery, and archiving data and files, and disaster recovery demonstration testing. Screen views shall be including an explanation of each field, drop-down menu choice, links, and navigation buttons.

System User Manuals required for the project include the following, at a minimum:

1. Reporting manual (refer to Section 2.19.1, Reports Manual)
2. Roadside system flow diagram (that illustrates how the roadside works to generate transactions/images and send upstream for host processing)
3. DVAS Manual
4. Audit and Reconciliation Manual
5. Dynamic Pricing and Trip Building Manual
6. MOMS User Manual

2.20 INTELLIGENT TRANSPORTATION SYSTEMS (ITS) MAINTENANCE

CTRMA may request the TSI to perform maintenance services on the existing and/or proposed ITS, as identified in this document. These supplemental services may include installation, maintenance, and repairs for existing and future ITS devices and infrastructure, owned by CTRMA, referred to hereinafter as the ITS. The ITS may consist of, but is not limited to, the following:

1. Device grounding and surge suppression
2. Conduit, laterals, and duct bank
3. Communications cable
4. Pull, splice, and junction boxes
5. Electrical power service assemblies
6. Device poles and mounting assemblies

7. Radar Vehicle Sensing Device (RVSD)
8. Bluetooth reader devices
9. Equipment, network, and remote cabinets
10. Video equipment, including CCTV cameras, video encoders/decoders, and video wall components
11. Network devices, including aggregation/distribution, edge switches, terminal servers, Ethernet extenders, and media converters
12. Highway signing, including DMS, embedded dynamic messaging signs (EDMS), and electronic display signs, as well as supporting structures
13. Connected Vehicle (CV) infrastructure, including roadside units (RSU) and in-cabinet equipment
14. Wrong Way Driving Systems (WWDS)
15. Wireless communication devices
16. Communications hubs and equipment shelters
17. Environmental conditioning equipment
18. UPS (future)
19. Ramp metering assemblies (future)
20. Visibility Sensors (future)
21. Road weather information systems (RWIS) (future)
22. Ancillary facilities (i.e., LoneStar® data servers and workstations)
23. Advanced Traffic Management Systems (ATMS) software
24. Application-Specific software packages (e.g., Video Analytics, Connected Vehicle applications)
25. Automated License Plate Readers (ALPRs)
26. Hardware, software, and firmware related to ITS equipment and other traffic control devices

2.20.1 Services to be Provided

Maintenance of the ITS may include scheduled maintenance, non-scheduled maintenance and repairs, and emergency repair services.

2.20.1.1 Scheduled Maintenance Services

The TSI will coordinate the frequency of scheduled maintenance services with CTRMA. The TSI will be responsible for responding to maintenance requests according to the priority assigned by CTRMA. At the discretion of CTRMA, the TSI may be dispatched to any work priority deemed appropriate by CTRMA.

2.20.1.2 Device Site Deficiencies

In the event the TSI encounters minor and/or major device deficiencies while performing preventive maintenance services as outlined above, the TSI shall correct such deficiencies during the preventive maintenance site visit whenever possible. CTRMA shall approve major device deficiencies corrections.

CTRMA considers minor deficiencies to be items such as, but not limited to, an unplugged device cable, tripped circuit breaker, or loose connector. CTRMA considers major deficiencies to be items such as, but not limited to, a non-functional device site with damaged equipment, components exposed to weather, exposed power cabling, or items constituting a safety hazard. The TSI would immediately contact CTRMA to report major deficiencies.

2.20.1.3 Non-Scheduled Maintenance and Repairs

Non-scheduled maintenance includes reactive maintenance, replacements, and diagnostic work necessary to correct deficiencies and keep the ITS operational. This work is not scheduled but is often generated by failures caused by acts of God, construction, or accidents. Non-scheduled maintenance may include, but is not limited to:

1. Field repair or replacement of ancillary parts or equipment for any ITS device
2. Resetting DMSs
3. Resetting and focusing CCTV lenses
4. Resetting RVDS
5. Resetting RSUs
6. Resetting WWDS detection
7. Configuring or repairing the communications network, including switches and terminal servers
8. Configuring or repairing CCTV video transmission equipment, including encoders and decoders, as applicable
9. Testing fiber optic cable (FOC) for optical budget requirements
10. Repairing damage caused by vandalism or accidents

If the cause of a failure is unknown, CTRMA may have the TSI perform diagnostic work as required to determine the cause of the failure.

2.20.2 Diagnostic and Troubleshooting Services

The TSI may be required to provide diagnostic and troubleshooting services when equipment is inoperable, and field troubleshooting is needed to identify the problem, as coordinated with CTRMA. Diagnostic and troubleshooting services include, but are not limited to:

1. Field diagnostic testing and troubleshooting
2. Minor equipment repairs following diagnosis
3. Diagnostic and repair report/documentation
4. Equipment failure/defective equipment investigation

2.20.3 Repair Services

Repairs and/or parts replacement may be covered under this effort, as approved by CTRMA. The TSI will submit a written request(s) to CTRMA for approval of any additional labor usage and expenditures that are not covered. Descriptions of additional labor, materials, and equipment will be included as part of a work request as well as a justification for the work. Repairs that require expertise and/or specialized equipment of the manufacturer will be considered original equipment manufacturer (OEM) repairs. OEM repairs are those specialized repairs that cannot be made by the TSI and must be made by a manufacturer or vendor of the

equipment/component. In the event a device manufacturer is no longer producing, selling, or repairing a specific device, the TSI will research, price, and present an alternative product to CTRMA.

The TSI is required to assure CTRMA that warranties are not voided by TSI repair services or other actions of the TSI at any point during the contract. If a device warranty expires, the TSI will notify CTRMA for the option to renew and/or replace the device if the unit is non-operational.

2.20.3.1 Field Site Repair

The TSI will have the necessary equipment and personnel capable of maintaining and repairing the field equipment and infrastructure deployed throughout the geographic coverage area of CTRMA. This includes a variety of devices and communications infrastructure. Field site repair includes, but is not limited to, device replacement, electrical service work and repair, optical fiber cable splicing and troubleshooting, Optical Time Domain Reflectometer (OTDR) testing, fiber enclosure/fiber distribution panel installations, and terminations, as necessary.

The TSI will have the capability to install both open trench and directional bore conduit for new installation and replacement of damaged conduit. It may be the responsibility of the TSI to perform all subsurface utility engineering (SUE) and obtain any permits required before the TSI commences any work, as requested by CTRMA. After completion of the device and/or communications infrastructure work by the TSI, a report will be presented to CTRMA for record-keeping of changes made to the fiber communication infrastructure and other components of the ITS.

1. **Minor Repair:** Minor repairs/replacement of ITS components due to equipment malfunction or end-of-service-life. Minor repairs also include, but are not limited to, reattaching loose cable connections, power reset of all equipment, and other incidental repair work. The TSI will perform the necessary repair/replacement work, which includes diagnostic services.
2. **Major Repair:** Major repairs are defined as non-typical repairs that need diagnostic services to identify the problem, extensive repair services, MOT and lane closures, utility coordination, or other regional agency coordination, such as damage caused by crashes, vandalism, theft, weather events, fiber cuts, power loss from the utility service point, and construction activity. Typical major repairs and parts replacement consist of but are not limited to, repair or replacement of damaged, missing, or malfunctioning equipment to maintain the ITS operation and functionality.
3. **Warranty Repair:** The TSI will act on behalf of CTRMA to track manufacturer warranties and pursue warranty repairs from device manufacturers when the manufacturer's warranty covers failures. The TSI is responsible for coordinating warranty repairs with CTRMA and the device manufacturer/reseller.

2.20.3.2 Equipment Replacement

This work may include furnishing replacement devices needed for the maintenance of the ITS, as required. Technical data sheets for all new replacement parts will be required to be

submitted and approved by CTRMA. Proposed replacement parts will be the latest compatible technology, equal to or better in function and quality to existing ITS components or equipment.

2.20.4 Emergency Repair Services

Emergency services consist of the restoration of components resulting from any malfunction or damage that creates a safety hazard or severely reduces the operational effectiveness of the overall ITS. The TSI may immediately correct any safety hazards discovered in the ITS, as requested by CTRMA. Failures tend to be caused by severe and unusual forces of nature, crashes and collisions, vandalism, theft, fire, erosion, and extreme exposure to chemicals or pollutants.

The TSI will be required to document malfunction and damage that necessitates emergency repair services. At a minimum, documentation will include:

1. Device location, type, model, and serial and control number
2. Date and time of the incident
3. Cause of failure and name of the person reporting failure
4. The site needs analysis and digital photo documentation
5. Immediate repairs and corrective actions are taken, including temporary repairs and repair cost breakdown
6. Corrective actions necessary for permanent repairs to be performed, including parts list, schedule, and estimated cost

2.20.5 Equipment Logs

The TSI will be required to document equipment and activities performed at each ITS device location. The TSI will be required to maintain an equipment log that documents preventive scheduled maintenance and repair services, including repair logs, parts replacement, special notes, recommendations, and equipment warranty records. Device records will be required to include, but will not be limited to:

1. Device location, number, and type
2. Model and serial number
3. Firmware version
4. Manufacturer
5. Date, time, and description of the failure
6. Report of failure source
7. Response details including arrival time, site conditions, and actions are taken
8. Resolution details with documentation
9. Spare part used, including type, model, serial, and control number
10. Replacement part notes and repair actions

2.21 DATA PLATFORM

CTRMA may request at CTRMA's option the TSI to develop a back-office architecture design that provides to provide additional Data Platform Hosting and development of a transaction processing system, including the following:

1. Centralized, secure, and redundant data hosting for all data entities necessary for toll transaction processing
2. External data exchange points that provide flexible structured transaction data transmissions to and from third parties
3. Multi-step modular pricing and discounting business logic
4. Auditable data governance and security
5. UX/UI-driven data and business process administration
6. Public, external, and internal fixed reporting & cached data access

2.21.1 Data Platform Releases

CTRMA has organized the Data Platform program into multiple releases as described in Sections 2.21.1.1 through 2.21.1.6.

2.21.1.1 Release 1 Data Platform

1. Assessment, selection, and implementation of hosting solution(s)
2. Hosting topology design and hardware/software implementation
3. Selection, licensing, and implementation of data platform application(s)
4. Defining rules/requirements for Availability, Retention, and Recovery
5. Availability, Capacity, Redundancy, Security, et. al. declaration and testing
6. Development of Fixed Toll Road Transaction database(s) and relationships
7. Design, development, and testing for external Fixed Toll Road Transaction data exchanges (Fixed file, API, XML, JSON)
8. Policies & Procedures documentation
9. Initialization of Source Data Entity Catalog
10. Assessment, selection, and implementation of e-discovery toolset(s)

2.21.1.2 Release 2 Interim Routing & Data Exchanges

1. Development of IOP Hub database(s) and relationships
2. Development of DMV Hub database(s) and relationships
3. Design, development, and testing for external IOP Hub data exchanges (Fixed file, API, XML, JSON)
4. Design, development, and testing for external DMV Hub data exchanges (Fixed file, API, XML, JSON)
5. Policies & Procedures documentation
6. Revision of Source Data Entity Catalog
7. Development of automated business process(es) for payor ID and payment path routing logic

8. Development of UX/UI for monitoring and reporting of automated business process(es) for payor ID and payment path routing logic

2.21.1.3 Release 3 Data Governance & Reporting Cache

1. Development of Reporting Cache data platform
2. Development of Public Reporting database(s) and relationships
3. Implementation and testing of data push from master data source to Reporting Cache
4. Development of automated Public Report(s) generation
5. Design, development, and testing for Public Reporting data exchanges (Fixed file, API, XML, JSON)
6. End-to-end testing of Reporting Cache and Public Reporting exchange solutions
7. Support for establishment of Data Governance strategy and approach
8. Definition of Data Use criteria
9. Automation of Data Governance process(es) including certification and affirmation for data use
10. UX/UI for administration and facilitation of Data Governance process(es)
11. Documentation of Data Governance Policies & Procedures
12. Development of Data Governance Awareness training, compliance, and certification
13. Declaration and implementation of Data Governance Audit(s)

2.21.1.4 Release 4 Reporting & Analytics

1. Development of External Reporting database(s) and relationships
2. Development of Internal Reporting database(s) and relationships
3. Implementation and testing of data push from master data source to Reporting Cache
4. Development of automated External Report(s) generation
5. Development of automated Internal Report(s) generation
6. Design, development, and testing for External Reporting data exchanges (Fixed file, API, XML, JSON)
7. End-to-end testing of Reporting Cache, Internal, and External Reporting exchange solutions
8. Assessment, selection, procurement, and implementation of Internal Reporting & Analytics tool(s)
9. Development of initial suite of internal analytics reports (per identification and prioritization)

2.21.1.5 Release 5 Pricing & Invoicing Automation

1. Development of Product database(s) and relationships
2. Development of Discount database(s) and relationships
3. Development of Invoice database(s) and relationships
4. Design and development of automated Product Management process(es)
5. Design and development of UX/UI for Product Management
6. Design and development of automated Discount Management process(es)

7. Design and development of UX/UI for Discount Management
8. Design and development of automated Invoice Management process(es)
9. Design and development of UX/UI for Invoice Management
10. Development of UX/UI for monitoring and reporting of automated business process(es) for end-to-end Transaction Pricing & Invoicing process(es)
11. Design, development, and testing for Pay by Mail('PBM') Invoice data exchanges (Fixed file, API, XML, JSON)
12. Design, development, and testing for IOP Hub Invoice data exchanges (Fixed file, API, XML, JSON)

2.21.1.6 Ongoing Operations, Maintenance and Support

1. Managed Services for Hosting Administration & Support
2. Managed Services for Database Administration & Support



CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

**Agreement
for
Electronic Toll Collection System
Integration and Maintenance Services**

Appendix 10

Lane System Business Rules

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10 BUSINESS RULES

10.1 PURPOSE

The purpose of this document is to track and maintain the CTRMA’s business rules. This document is a living document. When a business rule is changed, the “Last Update” date will be updated with the date the rule was recorded. Any additional notes may be maintained in the revision history.

Values stated in the “Value” column of the rules are understood to be user-configurable and not system-related changes.

10.2 GENERAL BUSINESS RULES

General business rules apply to every transaction unless superseded by a rule within the Express Lanes Business Rules section.

10.2.1 Transaction Pricing Business Rules

The business rules in this section address the aspects of applying toll rates to transactions.

Table 10-1: Transaction Pricing Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
CTRMA-TLP-1	LBR-TR-01	Time of Day Pricing	Toll rates are variable based on a pre-defined time of day pricing that is configurable per hour of day and day of the week.	December 2019
CTRMA-TLP-2, BR-1	BR-1	Axle-based Classification	Vehicle classification methodology used at CTRMA. Toll rates are variable based on the pre-defined Axle-based classification scheme.	December 2019
BR-2, CTRMA-TC-3	BR-2	2 through 6	Allowable vehicle classifications.	December 2019
BR-3, CTRMA-TC-3	BR-3	<= 2 axles	The number of axles on a class 2 vehicle.	December 2019
BR-4, CTRMA-TC-3	BR-4	3 axles	The number of axles on a class 3 vehicle.	December 2019
BR-5, CTRMA-TC-3	BR-5	4 axles	The number of axles on a class 4 vehicle.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
BR-6, CTRMA-TC-3	BR-6	5 axles	The number of axles on a class 5 vehicle.	December 2019
BR-7, CTRMA-TC-3	BR-7	6+ axles	The number of axles on a class 6 vehicle.	December 2019
CTRMA-TLP-3	LBR-TR-02	Toll Rate Configuration	Toll rates may be configured based on how the transaction originated (AVI, Video), and how the transaction is pursued (Processing Hub based on the TVL or LVL, or Toll Bill process (Pay by Mail) and the vehicle's Axle-based Classification.	December 2019
CTRMA-TLP-4, BR-8	BR-8	AVI Toll Rate	Toll rate applied for AVI Transactions that match to a valid entry in the TVL, the toll rate applied will be the AVI Rate.	December 2019
CTRMA-TLP-4a, BR-8	BR-500	AVI Toll Rate	Toll rate applied to Image-based Transactions that match to a valid entry in the TVL.	December 2019
CTRMA-TLP-5, BR-9	BR-9	PBM Toll Rate	Toll Rate applied to Image-based Transactions matched to a valid entry in the LVL.	December 2019
CTRMA-TLP-6, BR-10	BR-10	PBM Toll Rate	Toll Rate applied to Image-based Transactions that do not match to a valid entry in the TVL or LVL and are pursued through the Toll Bill process in the BOS.	December 2019
CTRMA-TLP-8	LBR-TR-03	Toll Rate Implementation	A new rate will go into effect immediately following the scheduled time or day as dictated according to the pre-defined time of day schedule.	December 2019
BR-18, BR-20	BR-18	\$0.00	Toll Rate when the lane is closed.	December 2019

10.2.2 In-Lane Transaction Processing Business Rules

This section describes the business rules related to transaction processing at the lane level.

Table 10-2: In-Lane Transaction Processing Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
BR-11	BR-11	Vehicle presence (every vehicle's image is saved)	Reasons for saving an image of the vehicle in the lane.	December 2019
BR-12	BR-12	Front and Rear	Images saved for each vehicle in the lane.	December 2019
BR-13	BR-13	Minimum of 1 image	The number of images saved of the front of the vehicle.	December 2019
BR-14	BR-14	Minimum of 1 image	The number of images saved of the rear of the vehicle.	December 2019
BR-15	BR-15	AVC	Default vehicle classification (unless the vehicle classification system is degraded).	December 2019
CTRMA-TC-4, BR-16	BR-16	Transponder class (if a tag is present) or Class 2 (2 axles)	Default vehicle classification if the AVC is degraded. Transactions created when the vehicle classification system is degraded are flagged and reported.	December 2019
CTRMA-TC-1, BR-19	BR-19	Spurious Tag Read	Transponders that were sent from the Reader to the Zone Controller properly but were unable to be correlated to a vehicle/transaction in Zone Controller and TFH correlation, are recorded as a spurious tag read and not used for any further processing. Spurious Tag Reads are reported to assist in measuring lane	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
			performance for all tolling points.	
CTRMA-TC-2	BR-501	Buffered Tag Read	<p>Transponders that were not sent from the Reader to the Zone Controller properly (delayed) but were unable to be correlated in TFH correlation, are recorded as a Buffered Tag Reads and not used for any further processing.</p> <p>Buffered Tag Reads are reported to assist in measuring lane performance for all tolling points.</p>	December 2019
CTRMA-TC-3	BR-502	Normal Tag Read	<p>Transponders that were successfully sent from the Reader to the Zone Controller and correlated to vehicle/transactions are recorded as a "Normal" Tag Read Transaction and processed in accordance with approved business rules and workflows.</p> <p>Normal AVI Transactions are reported to assist in measuring lane performance for all tolling points.</p>	December 2019
CTRMA-TC-7, BR-17	BR-17	Multi-transponder Reads	<p>If multiple Transponders are read in the lane for one vehicle, the first Valid Tag with the most recently updated tag status is used. All other transponder reads are recorded and associated with the transaction, but not used for billing purposes.</p>	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
			The transponder used for payment or billing is marked as such.	
CTRMA-TC-5	LBR-TP-01	Date/Time the vehicle exits the toll point	Transaction Date/Time. The timestamp of the transaction. The format of the timestamp is to the millisecond: HH:MM:SS.000. Note: The following timestamps are available for reporting: entry (when the transaction enters the tolling zone,) tag acquisition (when the tag is read), and exit (when the transaction exits the tolling zone.)	December 2019
CTRMA-TC-6, BR-22	BR-22	Tag Status	Transponders that are read and included in AVI Transactions are compared to the Tag Validation List in the Central Host to determine tag status. The tag status is recorded in the transaction.	December 2019

10.2.3 Image Review Business Rules

This section describes the business rules related to image review.

Table 10-3: Image Review Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
BR-40	BR-40	Unlimited	The number of times an image can be reviewed.	December 2019
BR-45	BR-45	100%	Percentage of transactions and images requiring review after the transactions and images enter the image review process.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
CTRMA-OCRIR-1, BR-41	BR-41	OCR Review	Each image of a transaction will go through OCR review first and be assigned an OCR confidence value.	December 2019
CTRMA-OCRIR-2	LBR-IR-01	Manual Review	A manual review is performed at the transaction level. Individual transactions are sent for manual review, and one result is returned for the transaction (rather than one result per image).	December 2019
NEW	LBR-IR-02	Front Image	Image selected when the vehicle classification is > 2 axles.	December 2019
CTRMA-OCRIR-3	LBR-IR-03	Every Image (configurable)	Image confidence requiring manual image review.	December 2019
CTRMA-OCRIR-4	LBR-IR-04	Manual Review Result	If a transaction is sent to manual review, the result of this review will take precedent over any other reviews performed by OCR. In other words, the manual review result is always the license plate value that will be applied to the transaction.	December 2019
CTRMA-OCRIR-5, BR-46	BR-46	No Plate, Motorcycle, Out-of-State, Temporary Plate, Unreadable Plate, Camera Issue	Manual Image "Code offs" during Image Review.	December 2019
CTRMA-OCRIR-6	LBR-IR-05	Supervisor Escalation	A manual review will be escalated to a supervisor for review if one of the following conditions is met: <ol style="list-style-type: none"> 1. The transaction is marked as a code-off 2. The transaction has had 4 (configurable) 	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
			reviews without two (configurable) matching reviews	
BR-42	BR-42	2	The number of times an image review must match before the review is accepted (includes being coded off).	December 2019
BR-43	BR-43	14 days from the Transaction Date	The maximum amount of time an image should be in image review.	December 2019
CTRMA-OCRIR-7	LBR-IR-06	Image Review Complete Criteria	Image review will be considered complete when one of the following conditions is met: <ol style="list-style-type: none"> 1. The transaction has two independent matching reviews 2. The transaction has been reviewed by a supervisor 	December 2019
CTRMA-OCRIR-8	LBR-IR-07	OCR Review Qualification	The result of OCR will be counted as one of the 4 (configurable) allowable reviews when the confidence level is ≥ 90 (configurable).	December 2019
CTRMA-OCRIR-9	LBR-IR-08	Rejected Transaction Finalization	Transactions that are rejected (coded-off) during image review will not be pursued further.	
BR-44	BR-44		At any time, a supervisor may override the image review results prior to the transaction exiting the image review process, and the review will be accepted.	December 2019
BR-32	BR-32		After image review, rejected images (a.k.a. "code offs") will not be pursued further.	December 2019

10.2.4 Central Host Processing Business Rules

This section describes the business rules related to the processing of Transactions at the Central Host.

Table 10-4: Central Host Processing Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
BR-35	BR-35		An Exempt Vehicle List (containing license plates and tags) is maintained so that vehicles, in accordance with CTRMA’s non-revenue policy, are allowed non-revenue access. For example, First Responders are maintained on this list.	December 2019
BR-36	BR-36		Exempt Vehicle List may be used for quarantining transactions from license plates that have special billing arrangements with CTRMA.	December 2019
CTRMA-HP-11, BR-33, BR-34, BR-38	BR-33	Exempt Vehicle Processing, TVL, LVL	Order in which Transactions are processed. Every Transaction should be compared to the following: <ol style="list-style-type: none"> 1. The Exempt Vehicle List before any payment processing takes place. If the vehicle exists in good standing within the Exempt Vehicle List, the transaction should be marked as non-revenue, and no further processing takes place. 2. If there is no match to the Exempt Vehicle List, the Transaction is 	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
			<p>compared to the TVL</p> <p>3. And, then, the LVL. If the transaction matched the TVL or the LVL, the transaction is sent to the processing hub.</p>	
NEW	BR-505	Duplicate Transaction	<p>Multiple transactions for the same vehicle shall not be processed, and may consist of the following:</p> <ol style="list-style-type: none"> 1. An AVI Transaction and Video Transaction for the same vehicle at the same location, direction, and time (within a threshold parameter). 2. Multiple AVI Transactions for the same vehicle at the same location, direction, and time (within a threshold parameter). 3. Multiple Video Transactions for the same vehicle at the same location, direction, and time (within a threshold parameter). 	December 2019
BR-23	BR-23	All, irrespective of status	<p>AVI Transactions are sent to the processing hub to determine if they will post to the Home Agency customer accounts or be accepted by the Home Agency.</p>	December 2019
BR-24	BR-24		<p>Transactions with a disposition of "Posted" from the processing hub will not be processed further.</p>	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
BR-37	BR-37		Transactions rejected by the Processing Hub that have already been through Image Review will be compared against the Non-Revenue list (again) before being sent for Toll Bill processing.	December 2019
BR-25	BR-25	999	The number of times a transaction can be resubmitted to the Processing Hub. It is expected that the time limit for resubmitting transactions will expire before the number of retries.	December 2019
	BR-503	10	The number of times a transaction is resubmitted when a "System/Communication Error" (S) is returned from the Processing Hub.	December 2019
	BR-504	3	The number of times a Transaction is resubmitted when a "Not Posted" (N) is returned from the Processing Hub.	December 2019
BR-26	BR-26	60 days from the transaction date	Amount of time the Central Host must submit or resubmit a transaction to the Processing Hub for processing.	December 2019
BR-27	BR-27		AVI Transactions must have a rejected Processing Hub disposition before being sent to image review.	December 2019
BR-28, CTRMA-HP-7	BR-28	96 hours	Amount of time the Central Host should wait for a disposition from the Processing Hub before alerting CTRMA of a potential problem.	December 2019
BR-29, CTRMA-HP-8	BR-29	15 days	The maximum amount of time the Central Host	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
			should wait for a disposition from Image Review before alerting CTRMA of a potential problem.	
BR-39	BR-39	Five days from the transaction date	Transactions must be sent to VPC for processing within this amount of time.	December 2019
CTRMA-HP-2	LBR-CH-01	25 Days	The number of days from the transaction date that the transactions must be sent for billing.	December 2019
CTRMA-HP-3	LBR-CH-02	Pay by Mail Sending Allowance	Pay by Mail transactions must be sent for billing within 60 (configurable) days of the transaction timestamp.	December 2019
CTRMA-HP-4	LBR-CH-03	Tag Transaction Image Review	Valid Tag-based transactions must have a final rejected HUB disposition (after being resubmitted, if applicable) prior to being sent for image review.	December 2019
CTRMA-HP-5	LBR-CH-04	iToll Processing	After Image Review, the plate will be compared against the TVL and License Plate Validation List (LVL) for qualification as an iToll transaction.	December 2019
CTRMA-HP-6	LBR-CH-05	LVL Matching	A transaction qualifies as matching a plate within the LVL if the plate assigned to the transaction matches a plate within the LVL that is either current or has expired in the last 30 (configurable) days.	December 2019

10.2.5 Data Retention Business Requirements

This section describes the business rules related to data retention.

Table 10-5: Data Retention Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
CTRMA-HP-9, BR-30	BR-30	7 (configurable) months from transaction date.	The maximum amount of time images will be stored for paid transactions.	December 2019
CTRMA-HP-10, BR-31	BR-31	2.5 years from the transaction date	The maximum amount of time images will be stored for transactions that have not been paid.	December 2019
NEW	LBR-DR-01	30 Days	Minimum number of days data must be stored in the Lane Controllers.	December 2019

10.3 EXPRESS LANE BUSINESS RULES

The business rules described in this Section will take precedence over those described in Section 10.2, General Business Rules.

10.3.1 Express Lane Usage Business Rules

This Section describes the business rules governing the use of the Express Lane by drivers.

Table 10-6: Express Lane Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELU-1	LBR-ELU-01	Express Lane Access	Access to the express lanes is only allowed at designated entry and/or exit locations.	December 2019
MOPAC-ELU-2	LBR-ELU-02	Express Lane Separation	The express lanes will be separated from the general-purpose lanes by barrier sticks.	December 2019
MOPAC-ELU-3	LBR-ELU-03	Segment Definition	The travel facility is divided into segments. Each segment consists of a single corresponding toll point. The northbound facility consists of the segments: <ol style="list-style-type: none"> 1. Enfield 2. Far West The southbound facility consists of the segments: <ol style="list-style-type: none"> 1. RM2222 2. Parmer 	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELU-4	LBR-ELU-04	Toll Point Definition	A toll point is a physical location where vehicles are detected by the transponder and/or license plate number.	December 2019

10.3.2 Express Lane Operations Business Rules

This section describes the business rules for operating the Express Lanes.

Table 10-7: Express Lane Operations Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELO-1	LBR-ELO-01	Tolling Operation	Express lane hours of operation shall be configured on a per-segment basis to a maximum of 24 hours a day, seven days a week, and 365 days a year.	December 2019
MOPAC-ELO-2	LBR-ELO-02	Non-Tolling Operation	During non-tolling operations, the express lanes shall be either closed or open to all vehicles.	December 2019
MOPAC-ELO-3	LBR-ELO-03	Non-Tolling Data Collection	During non-tolling operations, the system will continue to gather information, read transponders, and capture license plate images, but the collected data will not be utilized for billing purposes.	December 2019
MOPAC-ELO-4	LBR-ELO-04	Manual Overrides	The system may be manually placed in a non-tolling mode (as described in MOPAC-ELO-2), and the system will continue to gather data as described in MOPAC-ELO-3.	December 2019
MOPAC-ELO-5	LBR-ELO-05	VTMS Pricing Display	Each VTMS will display a maximum of 2 destinations at a time and the associated toll rates.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELO-6	LBR-ELO-06	VTMS Pricing Lock	During normal operations, a customer will be charged the price displayed on the VTMS at the point the customer enters the express lane.	December 2019
MOPAC-ELO-7	LBR-ELO-07	VTMS Non-Tolling Display	During non-tolling operation, the General Message LED Panel of the VTMS will display a configurable message up to 7 characters in length, including blanks.	December 2019
MOPAC-ELO-8	LBR-ELO-08	VTMS Comms Failure	In the event of a communications failure to the VTMS, the affected VTMS will display locally stored rates that are stored directly on the VTMS. The VTMS will initially display the last published message/toll rate for 10 minutes (configurable) before failing over to the locally stored rates.	December 2019
MOPAC-ELO-9	LBR-ELO-09	VTMS Display Failure	In the event of a display failure in which a VTMS is partially or completely blank, customers will be charged \$0.00.	December 2019
MOPAC-ELO-10	LBR-ELO-10	VTMS Incident Display	In the event of a traffic incident or lane closure, the toll rate message on the VTMS can be manually overridden by an authorized express lane operator with a message from a pre-determined set of allowable messages.	December 2019
MOPAC-ELO-11	LBR-ELO-11	VTMS Incorrect Fare	If a VTMS does not display the expected fare, the displayed fare shall be charged, and the system will immediately attempt to publish the correct rate.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELO-12	LBR-ELO-12	VTMS Toll Display	During the normal operational state, the VTMS will display toll rates determined by the following hierarchy: <ol style="list-style-type: none"> 1. The value was manually overridden/selected 2. Dynamic Pricing Algorithm 3. Time of Day Rate Schedule 4. Default Rates 5. Locally Stored Rates 	December 2019
MOPAC-ELO-13	LBR-ELO-13	Toll Rate Adjustment (Traffic Incident)	In the event of an incident or accident, Toll Rates for the entire Travel Facility or individual segment can be manually overridden by an authorized express lane operator. This override can be applied to the entire travel facility or one or more segments for a specified time and can include a past period (e.g., retroactively).	December 2019
MOPAC-ELO-14	LBR-ELO-14	ELO Toll Management	Authorized express lane operators will have the capability to manually set a toll rate or select the use of rate schedule pricing.	December 2019
MOPAC-ELO-15	LBR-ELO-15	Lane Closure (Maintenance)	The Express Lane may be placed in closed mode by segment as necessary to perform preventive and corrective maintenance on tolling equipment in the lane and on the roadside. During closures, VTMS will display a "CLOSED" message, and transaction data will be captured with a rate of \$0.00.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELO-16	LBR-ELO-16	VTMS Allowable Messages	The following approved messages are allowable when performing manual overrides of the VTMS: CLOSED FREE	December 2019

10.3.3 Express Lane Pricing Business Rules

The business rules in this section address all the aspects of traffic data collection/usage and setting/applying toll rates.

Table 10-8: Express Lane Pricing Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELP-1	LBR-ELP-01	Dynamic Pricing Definition	Toll rates are dynamically priced using a controller algorithm. The algorithm can consider only the Express Lane or a combination of both the Express Lane and the General-Purpose lanes traffic density and/or volumes and/or vehicle speeds to evaluate demand and determine the corresponding toll rate.	December 2019
MOPAC-ELP-2	LBR-ELP-02	Pricing Hardware Configuration (Express Lane)	The traffic detection devices shall feed the dynamic pricing controller algorithm traffic data from the Express Lane no less than every 30 seconds (configurable).	December 2019
MOPAC-ELP-3	LBR-ELP-03	Pricing Hardware Configuration (General Purpose Lane)	The traffic detection devices shall feed the dynamic pricing controller algorithm traffic data from the General-Purpose lanes no less than every 30 seconds (configurable).	December 2019
MOPAC-ELP-4	LBR-ELP-04	Rate Calculation	For each segment, all data from the traffic detection devices within the direction	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
		(Default Config)	of travel of the entire facility may be used for the algorithm's calculation.	
MOPAC-ELP-5	LBR-ELP-05	Rate Calculation (Required Data)	Based upon the traffic detection device mappings, 50% of lanes traffic data coverage is needed, and no more than 1.5 miles of spatial coverage can be missing in order for the algorithm to calculate the Toll Rate.	December 2019
MOPAC-ELP-6	LBR-ELP-06	Rate Calculation (Insufficient Data)	If the configurable number of mapped traffic detection devices are not available at the required interval or do not have data, the Toll Rate will be based upon the volume at the toll plaza points.	December 2019
MOPAC-ELP-7	LBR-ELP-07	Rate Calculation (Discarded Data)	If data from any specific traffic detection device is degraded or not available at the required interval to feed the algorithm, it will not be considered during the algorithm calculation.	December 2019
MOPAC-ELP-9	LBR-ELP-08	Rate Calculation (Subsegment Config)	Segments may have multiple traffic detection devices that take priority and have a higher value for the algorithm to consider.	December 2019
MOPAC-ELP-10	LBR-ELP-09	Minimum Toll Rate	The Minimum Toll Rate for any one segment trip is \$0.25 (configurable). The minimum Toll Rate for any multi-segment trip is \$0.50 (configurable).	December 2019
MOPAC-ELP-11	LBR-ELP-10	Maximum Toll Rate Facility	The Maximum Toll Rate allowed on the Express Lane during Hours of operation will be \$99.99 for the entire facility (configurable).	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-ELP-12	LBR-ELP-11	Toll Rate Display Interval	The Toll Rate displayed on the VTMS signs shall be automatically updated every 4 minutes (configurable).	December 2019
MOPAC-ELP-13	LBR-ELP-12	Toll Rate Increase Config	For each rate cycle, the Toll Rate will not automatically increase by more than \$1.00 per segment.	December 2019
MOPAC-ELP-14	LBR-ELP-13	Toll Rate Decrease Config	For each rate cycle, the Toll Rate will not automatically decrease by more than \$1.00 per segment.	December 2019
MOPAC-ELP-15	LBR-ELP-14	Full Trip Toll Rate	The entire Travel Facility price should never be less than an individual segment.	December 2019
MOPAC-ELP-16	LBR-ELP-15	Displayed Rate	The rate displayed on the VTMS will reflect the base price for an Automatic Vehicle Identification (AVI) transaction.	December 2019
MOPAC-ELP-17	LBR-ELP-16	Toll Scheduling	Dynamic Pricing will have configurable parameters (called toll schedules), and there can be numerous such toll schedules that can be used for different traffic/anomaly conditions.	December 2019
MOPAC-ELP-18	LBR-ELP-17	Manual Override & TOD Dynamic Pricing Impact	Dynamic Pricing will continue to run in the background when pricing is in time of day or manual mode.	December 2019
MOPAC-ELP-19	LBR-ELP-18	Maximum Manual Override Toll Rate Increase	The maximum toll rate increase implemented by a manual override shall be \$10.00.	December 2019
MOPAC-ELP-20	LBR-ELP-19	Maximum Manual Override Toll Rate Decrease	The maximum toll rate decrease implemented by a manual override shall be \$10.00.	December 2019

10.3.4 Trip Building Business Rules

This section focuses on how lane transactions from tolling points are associated with trips using the trip building process.

Table 10-9: Trip Building Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
BR-21	BR-21	Within 72 hours of the Transaction Date	Amount of time in which Trips must be built.	December 2019
MOPAC-TB-1	LBR-TB-01	Trip Transaction	Lane Transactions in the same direction of travel along the entire Travel Facility or a combination of Segments will be assembled into Trip Transactions in the Central Host.	December 2019
MOPAC-TB-2	LBR-TB-02	Trip Direction Restriction	Only transactions from the same direction of travel can be included in a trip per facility. The Mopac Express Lanes have the northbound or southbound direction of travel.	December 2019
MOPAC-TB-3	LBR-TB-03	Lane Transaction to Trip Transaction Relationship	A single unique Lane Transaction will not be included in more than one Trip Transaction. The relationship should be one or many Lane Transactions to a single Trip Transaction, not many Trip Transactions to a single Lane Transaction.	December 2019
MOPAC-TB-4	LBR-TB-04	Trip Travel Time	The allowable travel time for the northbound direction of travel shall be one hour, and southbound shall be one hour, both configurable. The travel time will establish the length of time for which transactions can be formed into a trip.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-TB-5	LBR-TB-05	Segment Travel Time	The allowable travel time for a given Segment shall be configurable.	December 2019
MOPAC-TB-6	LBR-TB-06	Lane Transaction Association to a Trip Transaction	Lane Transactions received at the Central Host shall be associated with the same Trip Transaction if the Lane Transactions meet the following criteria: <ol style="list-style-type: none"> 1. The transponder ID and/or license plate number identification is sufficient for the association. 2. A geographically possible sequence of segment transactions (for example, northbound progression). 3. The transaction is part of the defined trip definition of the trip transaction 4. Allowable Trip/Segment travel time. 	December 2019
MOPAC-TB-7	LBR-TB-07	Non-AVI Lane Transaction Association to a Trip Transaction	For vehicles with no transponder, the Lane Transactions will be associated with the same trip if the license plate numbers are determined to be for the same vehicle.	December 2019
MOPAC-TB-8	LBR-TB-08	AVI Lane Transaction Association to a Trip Transaction	If a Transponder ID is detected at all Toll Segments during a vehicle's travel, a trip transaction will be formed based on the common Transponder ID.	December 2019
MOPAC-TB-9	LBR-TB-09	Hybrid Lane Transaction	If the same Transponder ID is not detected at all Toll	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
		Association to a Trip Transaction	Segment, a Trip Transaction will be formed by mapping Transponder ID and license plate information from all the Lane Transactions. Transponder ID, if valid, will be associated with the trip for billing purposes.	
MOPAC-TB-10	LBR-TB-10	Trip Type Assignment Hierarchy	Once a trip is fully formed, the type of trip will be based on the following hierarchy: <ol style="list-style-type: none"> 1. Presence of Valid Tag 2. Image-Based Trip Note: all tags referenced above refer to Tolling Tags.	December 2019
MOPAC-TB-11	LBR-TB-11	Transaction Segments	If a Transaction Segment is received after the trip for which the segment belongs is built, the transaction segment will be saved and reported, but not processed.	December 2019
MOPAC-TB-12	LBR-TB-12	Trip Toll Point Duplicate	A single trip cannot contain more than one transaction for each unique Toll Point/segment within the trip.	December 2019
MOPAC-TB-13	LBR-TB-13	Consolidation of Trips	No more than a single Trip Transaction shall be sent for processing for every unique Express Lane Trip. Each Trip Transaction is unique in composition – no two trips can contain the same transaction(s).	December 2019
MOPAC-TB-14	LBR-TB-14	Trip Definitions	The Central Host shall define a set of configurable Trip Definitions which specify the various combinations of Toll Segment transactions that can be included in a single trip.	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-TB-15	LBR-TB-15	Split Trips	If a customer exits the Express Lane and decides to re-enter after the configurable allowable travel time for the entire Travel Facility has passed, two separate trips shall be constructed, and the toll rate from the initial entry is considered expired. Trips are formed through the detection and inclusion of transactions at each Toll Segment in each Trip Definition. The occurrence of a transaction at Toll Segments within a given Trip Definition shall not be assumed; a valid transaction must be recorded at every Toll Point in the Trip Definition; otherwise, the transactions will form separate Trips.	December 2019
MOPAC-TB-16	LBR-TB-16	Orphan Trips	If an image-based transaction cannot be identified by Optical Character Recognition (OCR)/Manual Image Review, the transaction will form a single point trip filtered as unidentifiable.	December 2019

10.3.5 Transaction Rating Business Rules

This section describes the business rules related to the transaction rating.

Table 10-10: Transaction Rating Business Rules

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
MOPAC-TR-1	LBR-TR-01	Transaction Tag Status	Transponder status determined at the Central Host will be maintained throughout the life of the	December 2019

Old Rule	Business Rule Number	Value/Term	Condition/Rule Description	Last Update/Verification
			transaction until transmission to BOS.	
MOPAC-TR-2	LBR-TR-02	Trip Tag Status	If transponder-based trips contain transactions with both Valid and Invalid tag statuses, the Valid tag status will be applied to the trip.	December 2019
MOPAC-TR-3	LBR-TR-03	Toll Rate Assignment	The toll rate applied to a trip will be the toll rate seen by the customer at the first VTMS that applies to that trip definition, and this toll rate is locked in for the duration of the trip.	December 2019
MOPAC-TR-4	LBR-TR-04	Sign Travel time	Sign Travel time will be used to calculate the time after a rate is posted for when the rate will become effective for billing. This time is configurable, and sign based.	December 2019
MOPAC-TR-5	LBR-TR-05	Toll Rate Increase Implementation	A toll rate increase will go into effect after one of the following is met: <ol style="list-style-type: none"> 1. Two tags have been seen at both the sign tag reader and the plaza tag reader 2. Sign travel time has elapsed. 	December 2019
MOPAC-TR-6	LBR-TR-06	Rate Decrease Implementation	A toll rate decrease will go into effect immediately after the rate is posted to the sign.	December 2019
MOPAC-TR-7	LBR-TR-07	Closed Pricing	The toll rate for a closed segment will be \$0.00 (configurable).	December 2019
MOPAC-TR-8	LBR-TR-08	Open to All Pricing	The toll rate for a "FREE" segment will be \$0.00 (configurable).	December 2019



CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

**Agreement for
Electronic Toll Collection System
Integration and Maintenance Services**

Appendix 12

Data Retention Schedule

CONTENTS

12	Data Retention General Guidelines	12-1
12.1	Data Retention Guidelines General Requirements.....	12-1

LIST OF TABLES

Table 12-1:	Data Retention General Guidelines General Requirements.....	12-1
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12 DATA RETENTION GENERAL GUIDELINES

The Toll System Integrator (TSI) shall retain the different data types for the durations described below. Once the online retention period has been reached, the TSI may archive data off the system. Should CTRMA request any archived data from the TSI, it shall be produced for CTRMA within a single business day.

FE = Fiscal year-end

12.1 DATA RETENTION GUIDELINES GENERAL REQUIREMENTS

Table 12-1 provides information regarding the data retention general requirements.

Table 12-1: Data Retention General Guidelines General Requirements

Data Type	Category	Online Retention Period*	Long Term Storage Requirement
Images	Unpaid transactions	FE + 1 year	Term of contract + 120 days
Images	Paid transactions	FE + 1 years	Term of contract + 120 days
Images	Non-pursuable (code-offs, exempt, etc.)	FE + 1 years	Term of contract + 120 days
Transponder and Video-based Transaction Data	Unpaid transactions	FE + 1 year	Term of contract + 120 days
Transponder and Video-based Transaction Data	Paid transactions	FE + 1 years	Term of contract + 120 days
Transponder and Video -based Transaction Data	Non-pursuable (code-offs, exempt, etc.)	FE + 3 years	Term of contract + 120 days
DVAS Video Data	All	90 days	No long term storage required
Rate Tables	All	FE + 5 years	Term of contract + 120 days
Traffic Data	All	FE + 1 year	Term of contract + 120 days
System Logs	All	30 days	Term of contract + 120 days
MOMS Data	All	FE + 1 year	Term of contract + 120 days
Application Configuration Files	All	90 days	Term of contract + 120 days

Data Type	Category	Online Retention Period*	Long Term Storage Requirement
Tag Validation List (TVL) and License Plate Validation Lists (LVL)	All	Six months	Six months

*Online retention period not to exceed the term of the contract + 120 days.

APPENDIX B
Form of Work Authorization



CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY

WORK AUTHORIZATION

WORK AUTHORIZATION NO. XX (CTRMA-designated number)
TOLL SYSTEM IMPLEMENTATION

ENTER FULL TOLL ROAD/PROJECT NAME HERE

THIS WORK AUTHORIZATION is made this ___ day of (enter month and year here) pursuant to the terms and conditions of (insert reference to necessary articles, attachments, general provisions, etc. of the Master Agreement/Contract here), to the original Contract for Toll System Implementation, dated (insert Master Agreement/Contract execution date here) (the Contract) entered into by and between the Central Texas Regional Mobility Authority (the "Authority" or "CTRMA"), and (insert full system integrator company name here) (the "Contractor," also referred to in attachments to this WA No. XX as the "System Integrator" or "SI").

PART I. The Contractor shall perform system development, implementation and integration services generally described in the Scope of Work attached hereto as Attachment A. The Contractor's duties and responsibilities are further detailed in: (1) Project Layouts/Schematics included as Attachment B, (2) the Project Responsibility Matrix included as Attachment C, and (3) the Tolling Standards included as Attachment D.

PART II. The maximum amount payable under this WA No. XX is \$(insert CTRMA-approved project not-to-exceed budget here). This amount is based generally upon the estimated fees documented in Attachment E.

PART III. Payment to the Contractor for the services established under this WA No. XX shall be made in accordance with the Contract (insert reference to Master Contract here).

PART IV. This WA No. XX shall become effective on the date both parties have signed this WA No. XX. This WA No. XX will terminate upon the Authority's final acceptance of the work described herein as determined by CTRMA. The work shall be performed in accordance with the project Schedule and Milestones as set forth in Attachment F.

PART V. This WA No. XX does not waive any of the parties' responsibilities and obligations provided under the Contract, as such responsibilities and obligations under the Contract remain in full force and effect.



IN WITNESS WHEREOF, this Work Authorization No. **XX** is executed in duplicate counterparts and hereby accepted and acknowledged below.

CTRMA DIVISION DIRECTOR (*Requesting Work Authorization*)

Signature

Date

Typed/Printed Name and Title

CTRMA LEGAL (*Noting Legal Sufficiency*)

Signature

Date

Typed/Printed Name and Title

CTRMA FINANCE (*Noting Funds Availability*)

Signature

Date

Typed/Printed Name and Title

THE CONTRACTOR (insert full system integrator company name here)

Signature

Date

Typed/Printed Name and Title

CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY

Executed for and approved by the Central Texas Regional Mobility Authority for the purpose and effect of activating and/or carrying out the orders, established policies or work programs heretofore approved and authorized by the Texas Transportation Commission.

Signature

Date

James Bass, Executive Director

Typed/Printed Name and Title

LIST OF ATTACHMENTS

Attachment A	Work Authorization Scope of Work
Attachment B	Project Layout/Schematics
Attachment C	Project Responsibility Matrix
Attachment D	Mobility Authority Tolling Guidelines
Attachment E	System Integrator Price Sheet and Budget
Attachment F	Project Schedule & Milestone Payments
Attachment G	Project Liquidated Damages/Penalties

ATTACHMENT A

CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY
TOLL SYSTEM IMPLEMENTATION
ENTER FULL TOLL ROAD/PROJECT NAME HERE

WORK AUTHORIZATION SCOPE OF WORK

A1.0 GENERAL

A1.01. Background

This section of the work authorization shall provide a brief description of the project to provide enough background information to understand the project history, project size, type of project, etc. Information in this section generally includes, but not limited to:

- Purpose of the project / project goals
- Location of the project (e.g. county(ies) and/or list of roads at project boundaries)
- Length of the project
- Number and types of lanes (tolled lanes and any non-tolled frontage roads)
- Description of project phases, if applicable
- How the project is being funded
- List of stakeholders and their responsibilities on the project

A1.02. Summary Scope of Work

This section of the work authorization shall provide a high-level description of the system integrator's scope of work for the project. The content captured in this section shall be reflective of the SI's proposed/final scope of work in Attachment I.

A2.0 GENERAL DESCRIPTION – PROJECT INFRASTRUCTURE

This section of the work authorization shall provide a complete description of the project infrastructure that will be constructed in support of this project. This section shall describe all infrastructure improvements for the Project, not only those within the SI's scope of work. Information in this section generally includes, but not limited to:

- Length of the project
- Number and types of lanes (tolled lanes and any non-tolled frontage roads)
- Lane widths
- List of all direct connectors, overpasses, bridges, tunnels/under-crossings, etc. to be constructed and their location
- Description of pullouts for on-road enforcement
- List of tolling points on the facility (including mainline gantry and ramps) and their locations
- List of facility entrances and exits

(insert full Project name here)

WA XX

(insert last date modified here xx/xx/xxxx)

- Description of the duct bank, including but not limited to:
 - Types, sizes and number of conduits to be used for power and fiber optic cable
 - Whether there is an existing duct bank, whether the existing duct bank will be enhanced/modified, or a new one will be added to the project
 - Use of laterals and how far they will generally be spaced
- Description of the infrastructure at toll points, including but not limited to:
 - Infrastructure at mainline and/or ramp gantries
 - Toll equipment pads
 - Power/redundant power needs
 - Maintenance pullouts/driveways
- A table containing the details for all toll point(s) on the facility, including:
 - Gantry station location on latest plan set/schematics
 - Direction of travel
 - Number of tolled lanes
 - Number of shoulders over six (6) feet in width
 - Any comments necessary for each toll point to further clarify design details

A3.0 GENERAL REQUIREMENTS - TOLL COLLECTION SYSTEM

This section of the work authorization shall outline the general requirements for the systems falling under the SI's scope of work for the Project.

A3.01 General Requirements - Toll Collection System

This section shall outline the general requirements for the toll collection system. The information in this section is not meant to be an exact reflection of the contract system requirements, but provide a general overview technologies the SI shall implement on the facility, outline integration requirements and transaction processing requirements.

Information in this section generally includes, but not limited to:

- A general statement capturing interoperability requirements of the system.
- A description of the types of technologies to be deployed on the facility, for example:
 - Automatic vehicle identification (AVI)
 - Automatic vehicle classification (ACV)/Automatic Vehicle Detection and Classification (AVDC) Hardware and type (e.g. in-ground sensor, overhead laser/scanner, etc.)
 - Image Capture System (ICS) Hardware
 - Digital video auditing system (DVAS)
 - Other technologies necessary for toll collection/operation
- A description of the Project's testing phases
- A list all required documentation for the Project

A4.0 EQUIPMENT AND INSTALLATION

A4.01. Gantries and Roadside Equipment for TCS

This section of the work authorization shall outline the equipment the SI shall be required to provide for and the Project toll collection system, as well as outline the SI's installation responsibilities.

This section generally outlines the SI's Project responsibilities related to, but not limited to:

- Procuring, storing, installing, tuning, integrating and testing all TCS hardware, including but not limited to:
 - TCS devices and components, including wiring and mounting hardware
 - Fiber optic cables, including fiber optic cable laterals and all fiber and communications required at each tolling point
 - Power cables, circuits, etc.
 - Toll equipment cabinets, with appropriate environmental and climate control
 - MOMS software for all TCS and ITS devices
 - Electrical grounding systems
 - Lightning and surge protection systems
 - Backup power systems
 - Site security systems
 - Provision of power from a Mobility Authority service point
 - Conducting radio frequency survey at each toll site, obtaining necessary Federal Communication Commissioning licensing, monitoring all licensing expiration dates and managing the process of licensing and renewals.
- Designing, documenting, developing, testing, integrating and implementing all TCS software
- Procuring, installing, integrating and testing all necessary third-party software and licenses
- Monitoring all third-party software licenses for renewals and procurement to prevent lapses in software licensing
- Testing, certification and acceptance of all systems
- Outlining responsibilities for installation of infrastructure and equipment between the SI and other Project contractors

A5.0 PROJECT COORDINATION, MANAGEMENT AND COMMUNICATION

This section of the work authorization shall provide a comprehensive list of all required coordination efforts and touchpoints with the Mobility Authority, their Project stakeholders and the SI throughout the duration of the Project.

Information in this section generally includes, but not limited to:

- A general statement noting the SI is responsible for participating in the design of the infrastructure for toll facilities.
- A general statement noting the SI is responsible for building and maintaining relationships and direct lines of communication between the Mobility Authority and other Project stakeholders as identified by the Mobility Authority.
- A detailed list of SI coordination efforts, touchpoints and responsibilities throughout the

Project, including but not limited to:

- Over-the-shoulder infrastructure design reviews
- Development of various documents and tools to communicate project status, installation requirements, or other critical aspects of the Project, including but not limited to:
 - TCS infrastructure dependency matrix
 - Installation plans and drawings
 - SI TCS schedule
- Attending various project meetings, detailing who is responsible for agendas and notes
- Participating in the development of a Master Project schedule
- Coordinating infrastructure changes during design and/or construction
- Coordinating the development of a process to formally review, validate and accept constructed infrastructure at TCS sites
- Communicating requirements needed from Mobility Authority and Project stakeholders for system testing

A6.0 WORK BY OTHERS

This section of the work authorization shall outline the civil design and construction activities that are *not* the responsibility of the SI.

Information in this section generally includes, but not limited to:

- SI responsibilities regarding infrastructure design
- SI communication and relationship responsibilities with the Mobility Authority and other Project stakeholders as identified by the Mobility Authority
- A list of SI coordination efforts, touchpoints and responsibilities throughout the Project, including but not limited to:
 - Over-the-shoulder review participation
 - Development of various documents and tools to communicate project status, installation requirements, or other critical aspects of the Project, including but not limited to:
 - TCS infrastructure dependency matrix
 - Installation plans and drawings
 - SI TCS schedule
 - Attending various project meetings
 - Participating in the development of a Master Project schedule
 - Coordinating infrastructure changes during design and/or construction
 - Coordinating the development of a process to formally review, validate and accept constructed infrastructure at TCS sites
 - Communicating requirements needed from Mobility Authority and Project stakeholders for system testing

A7.0 TOLL FACILITIES RESPONSIBILITY MATRIX

This section shall refer to the SI to the Project responsibility matrix to provide a detailed delineation of responsibilities between the Project Contractor(s) and the SI.

A8.0 MASTER PROJECT CONSTRUCTION SCHEDULE

This section shall refer to the SI to the Project schedule in its current form.

[END OF SECTION]

SAMPLE

ATTACHMENT B

Project Layout

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This attachment shall contain visuals of the proposed project layout. Project layouts shall be included in their current form and may be subject to change.

SAMPLE

ATTACHMENT C

Project Responsibility Matrix **ENTER FULL TOLL ROAD/PROJECT NAME HERE**

This attachment shall contain the Project's responsibility matrix delineating responsibility between the SI and other Project Contractor(s). The responsibility matrix may vary by Project. See the example below for a Project Responsibility Matrix from a prior work authorization:

SAMPLE

Responsibility Assignment Legend							
Primary Responsibility: P		Support Responsibility: S		Coordination Responsibility Only: C			No Responsibility: N
Element/Task/Component/ Sub-system	Designer	Contractor		Systems Integrator (SI)			Comments Other Responsibility/Information
	Design	Procure	Install/ Construct	Design	Procure	Install / Construct	

GENERAL REQUIREMENTS							
Schedule	N	P	P	S	S	S	Contractor must accommodate and incorporate the SI scheduled activities into the project schedule. All schedule changes or updates which impact the SI tasks must be agreed to by the SI prior to submittal to CTRMA. A weekly schedule must be distributed and incorporate any SI updates or changes.
Request for Early Opening	N	P	P	S	S	S	The SI must be able to match schedule request for early opening. SI must be allowed early unencumbered access in order to meet early opening request.
Design Package – Installation and Electrical Design and Plans	P	P	P	C	N	C	Designer to incorporate all SI requirements and specifications into Structural and Electrical Design Packages. Contractor will coordinate installation activities with SI.
Grading	N	P	P	C	N	C	
Drainage		S	P	C	N	C	No culverts or pipes under tolling zones.
Utilities/Electrical Services	P	P	P	S	C	C	SI to provide specific power requirements for the Toll System to the Contactor. The contractor is to incorporate the toll facilities design and construct power utilities interface, and all power infrastructure. Contractor to provide power to the Toll System pad and ITS locations. SI to terminate power to their sites.”
Traffic Control/Safe work zone	N	P	P	S	N	C	SI to provide contractor detailed lane closure requirements and schedule for installation and testing.
Signing	N	P	P	C	N	S	All toll signing must be coordinated with and approved by CTRMA.
Striping	N	P	P	S	N	C	SI to coordinate striping with pavement loop locations. Contractor to coordinate with SI for loops installation and striping sequencing.
Lighting		P	P	S	C	S	Roadway and toll location lighting provided by contractor. SI to provide lighting requirements

(insert full Project name here)

WA XX

(insert last date modified here xx/xx/xxxx)

Responsibility Assignment Legend							
Primary Responsibility: P	Support Responsibility: S			Coordination Responsibility Only: C			No Responsibility: N
Element/Task/Component/ Sub-system	Designer	Contractor		Systems Integrator (SI)			Comments Other Responsibility/Information
	Design	Procure	Install/ Construct	Design	Procure	Install / Construct	
							in vicinity of toll locations and locations of other Toll System equipment. Contractor to confirm that lighting does not obstruct toll related signing or impede the Toll System.
TOLL SYSTEM: LOCATIONS, LAYOUTS, STRUCTURES, MOUNTS/BRACKETS							
Locations and Layouts	P	P	P	S	C	C	SI to provide specific locations for the Toll System. SI to provide requirements for specific lane and facility layouts. Designer to incorporate into Design Packages. The contractor will coordinate with SI during the installation activity.
Gantries/Foundation/Trusses/Junction boxes/Conduits/Grounding	P	P	P	S	C	S	SI to provide requirements for conduits (for SI installed power and communications cables, including specific requirement for below ground conduits for the loops), junction boxes, and power needs for the Toll System. The Designer to incorporate into structural design, including electrical grounding, bonding. Contractor to provide and install junction boxes and conduit pull strings and bell ends for all conduits up to one foot above pole and gantry foundation. The contractor will require SI to sign off on below ground conduits for the loops prior to installation of special pavement structure.
Gantries/Foundation/Trusses/Junction boxes/Conduits/Grounding	N	P	P	S	C	S	Contractor will provide conduits/wire ways on all the toll gantries for all the SI equipment.
EQUIPMENT CABINETS							
Automatic Vehicle Classification and Detection (AVC) and (AVD)	N	N	S	P	P	P	SI to install, connect and terminate AVC and/or AVD System mounted on the gantries and/or installed in the pavement to the electronics in the cabinets.
COMMUNICATIONS SUB-SYSTEMS							
DUCT BANK AND INTELLIGENT TRANSPORTATION SYSTEMS (ITS)							

(insert full Project name here)

WA XX

(insert last date modified here xx/xx/xxxx)

Responsibility Assignment Legend							
Primary Responsibility: P	Support Responsibility: S		Coordination Responsibility Only: C			No Responsibility: N	
Element/Task/Component/ Sub-system	Designer	Contractor		Systems Integrator (SI)			Comments Other Responsibility/Information
	Design	Procure	Install/ Construct	Design	Procure	Install / Construct	
New Duct bank	P	P	P	C	C	C	SI to provide requirements for new duct bank. Designer to incorporate into roadway design. SI to confirm that design plans meet requirements.
Fiber Installation	N	C	C	P	P	P	SI to provide, install and test the fiber.

ATTACHMENT D

Mobility Authority Tolling Standards

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This attachment shall contain the Mobility Authority's current tolling standards. Tolling standards may change based on the SI's review.

SAMPLE

ATTACHMENT E

System Integrator Price Sheet

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This attachment shall contain the detailed pricing sheet(s) as agreed to by the SI and the Mobility Authority.

Note: Because each Mobility Authority project will be different, each price sheet should contain the labor positions, their associated estimated hours, and associated hourly rates the SI used to develop the Project Price Sheet, noting any proposed or annual contract rate escalation percentage. Additionally, the SI shall provide a detailed breakdown of project cost estimates for, but not limited to, the following:

- TCS Equipment costs
- Program management costs
- Software design costs
- Software development costs
- Software testing costs
- Project documentation costs, broken out by each document required for the Project
- TCS installation costs
- Bonding costs

The pricing sheet shall also note any assumptions the SI made while developing the project pricing, as well as a detail list of items/activities not included in the project pricing.

ATTACHMENT F

Project Schedule & Milestone Payments

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This Attachment shall contain the project milestone payment schedule.

Because each Mobility Authority project will be different, Project Milestone Payment Schedules may vary from project to project. The following examples represent Milestone Payment Schedules for three (3) phases of work:

- Phase 1: Initial implementation of the toll host, first facility transition/installation and delivery of all program-level documentation.
- Phase 2: Includes transitioned or new facility after the toll host has been developed and deployed, project-specific documentation, and any program documentation requiring updates for the project.
- Phase 3: Includes transitioned facilities after the toll host has been developed and deployed, project-specific documentation, and any program documentation requiring updates for the project.

Refer to the Scope of Work in the RFP for example Milestone Payment tables.

ATTACHMENT G

Project Liquidated Damages/Penalties

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This attachment shall contain the Project liquidated damages and associated assessments.

Because each Mobility Authority project will be different, Project Liquidated Damages may vary from project to project. Liquidated Damages and associated assessments shall be agreed upon between the SI and the Mobility Authority, but shall generally be associated with:

- Not beginning work within 30 days of receiving NTP from the Mobility Authority
- Depending on the “phase” or type of project, each project schedule milestone, for example:
 - Approval of system design (including design documents, RTM, BOM)
 - Approval of installation plan and drawings
 - Approval of training, user and maintenance manuals
 - Approval of Factory Acceptance Testing
 - Approval of OFIT/1st Tolling Location Commissioning
 - Approval of Commissioning for All tolling locations
 - Go-live for all tolling locations
 - All ITS available for 1st toll location go-live
 - Approval of Operational Acceptance Testing

ATTACHMENT H

Master Project Schedule and Milestones

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This attachment shall contain the Master Project Construction Schedule in its current form. This schedule may change after approval of the Work Authorization.

SAMPLE

ATTACHMENT I

System Integrator Proposed Scope of Work

ENTER FULL TOLL ROAD/PROJECT NAME HERE

This attachment shall contain the SI's detailed scope of work.

Note: The format, contents and general makeup of the detailed scope of work shall be developed and mutually agreed upon by the selected Proposer and the Mobility Authority after execution of contract.

SAMPLE

APPENDIX C
Installation Services Unit Prices

**Appendix C
Installation Services Unit Prices**

SECTION / LINE		DESCRIPTION	UNIT	PROPOSED QTY	UNIT PRICE	APPLICABLE PRICE ADJUSTMENT INDICES ³		TOTAL PRICE
						CPI-U	WPU 117	
A	1	Mobilization						
	2	Mobilization (5% of B Subtotal)	Lump Sum	1	N/A	100%	0%	\$ 1,332,925.93
	3	Subtotal – Mobilization \$ 1,332,925.93						
B	4	System Procurement and Installation (includes: materials, software, equipment, labor, traffic control, and integration)						
B1-A	5-A	Open Road Toll Collection² – Existing Facilities/System Replacement w/ In-Ground AVD/C (including all Toll Zone equipment and roadside controller appurtenances and DVAS) ¹						
	6-A	One lane (no shoulder)	Each	5	\$ 127,349.66	50%	50%	\$ 636,748.31
	7-A	One lane + one shoulder	Each	6	\$ 177,967.80	50%	50%	\$ 1,067,806.82
	8-A	One lane + two shoulders	Each	0	\$ 254,764.41	50%	50%	\$ -
	9-A	Two lanes (no shoulder)	Each	0	\$ 207,513.30	50%	50%	\$ -
	10-A	Two lanes + one shoulder	Each	2	\$ 247,726.50	50%	50%	\$ 495,453.01
	11-A	Two lanes + two shoulders	Each	2	\$ 326,309.50	50%	50%	\$ 652,619.00
	12-A	Three lanes + two shoulders	Each	6	\$ 386,132.25	50%	50%	\$ 2,316,793.52
	13-A	Four lanes + two shoulders	Each	0	\$ 461,635.52	50%	50%	\$ -
	14-A	Five lanes + one shoulder	Each	0	\$ 522,246.69	50%	50%	\$ -
	15-A	Five lanes + two shoulders	Each	0	\$ 579,862.49	50%	50%	\$ -
B1-B	5-B	Open Road Toll Collection² – Existing Facilities/System Replacement w/ In-Ground and Supplemental Above Ground AVD/C (including all Toll Zone equipment and roadside controller appurtenances and DVAS) ¹						
	6-B	One lane (no shoulder)	Each	2	\$ 155,451.63	50%	50%	\$ 310,903.27
	7-B	One lane + one shoulder	Each	6	\$ 223,699.81	50%	50%	\$ 1,342,198.86
	8-B	One lane + two shoulders	Each	1	\$ 298,330.86	50%	50%	\$ 298,330.86
	9-B	Two lanes (no shoulder)	Each	3	\$ 239,424.73	50%	50%	\$ 718,274.19
	10-B	Two lanes + one shoulder	Each	5	\$ 320,014.69	50%	50%	\$ 1,600,073.45
	11-B	Two lanes + two shoulders	Each	0	\$ 437,079.80	50%	50%	\$ -
	12-B	Three lanes + two shoulders	Each	4	\$ 486,746.31	50%	50%	\$ 1,946,985.24
	13-B	Four lanes + two shoulders	Each	2	\$ 559,344.69	50%	50%	\$ 1,118,689.39
	14-B	Five lanes + one shoulder	Each	1	\$ 638,518.94	50%	50%	\$ 638,518.94
	15-B	Five lanes + two shoulders	Each	1	\$ 716,149.36	50%	50%	\$ 716,149.36
B2	16	Open Road Toll Collection – Future Facilities/New Construction w/ In-Ground AVD/C (including all Toll Zone equipment and roadside controller appurtenances and DVAS) ¹						
	17	One lane (no shoulder)	Each	0	\$ 128,899.45	50%	50%	\$ -
	18	One lane + one shoulder	Each	10	\$ 180,436.89	50%	50%	\$ 1,804,368.88
	19	Two lanes (no shoulder)	Each	0	\$ 209,964.20	50%	50%	\$ -
	20	Two lanes + one shoulder	Each	1	\$ 261,999.82	50%	50%	\$ 261,999.82
	21	Two lanes + two shoulders	Each	8	\$ 321,423.41	50%	50%	\$ 2,571,387.31
	22	Three lanes + two shoulders	Each	4	\$ 393,449.56	50%	50%	\$ 1,573,798.22
	23	Four lanes + two shoulders	Each	0	\$ 484,691.58	50%	50%	\$ -
B3	24	Toll Facility Host (including Systems and Subsystems (i.e. dynamic pricing, image review, trip building, etc.))						
	25	Toll Facility Host	Each	1	\$ 1,573,944.79	50%	50%	\$ 1,573,944.79
	26	Key Reports	Lump Sum	1	\$ 128,842.11	50%	50%	\$ 128,842.11
B4	27	Plaza Server						
	28	Plaza Server	Each	10	\$ 13,901.34	50%	50%	\$ 139,013.36
B5	29	ORT Roadside Equipment Cabinet						
	30	Toll Zone	Each	69	\$ 8,331.93	50%	50%	\$ 574,903.26
B6	31	Dynamic Pricing						
	32	Variable Toll Message Sign Components, associated CCTV, & Cabinet	Each	30	\$ 36,020.59	50%	50%	\$ 1,080,617.68
	33	Traffic Speed, Volume, and Density Detection Site w/Cabinet	Each	50	\$ 9,365.72	50%	50%	\$ 468,285.94
B7	34	Communication and Conduit						
	35	Communications Subsystem (includes: network switches, patch panels, installation, connections, and integration between communications demarcation and roadside cabinets)	Each	69	\$ 7,190.73	50%	50%	\$ 496,160.63
	36	Fiber optic communication cable (12-strand single-mode, additional footage up to 1 mile)	Feet	5280	\$ 14.46	50%	50%	\$ 76,325.04

**Appendix C
Installation Services Unit Prices**

SECTION / LINE	DESCRIPTION	UNIT	PROPOSED QTY	UNIT PRICE	APPLICABLE PRICE ADJUSTMENT INDICES ³		TOTAL PRICE	
					CPI-U	WPU 117		
	37	Copper/CAT-6 communication cable (additional footage up to 1 mile)	Feet	5280	\$ 9.32	50%	50%	\$ 49,219.10
	38	Rigid Metal (4") Conduit (additional footage up to 1 mile)	Feet	5280	\$ 73.22	50%	50%	\$ 386,626.94
	39	PVC Conduit (2", trenched, additional footage up to 1 mile)	Feet	5280	\$ 19.40	50%	50%	\$ 102,421.97
B8	40	Emergency Power and Back-up						
	41	Uninterruptible Power Supply	Each	69	\$ 8,410.28	50%	50%	\$ 580,309.02
	42	Emergency Generator (permanently installed)	Each	51	\$ 18,098.44	50%	50%	\$ 923,020.29
	43	Temporary/Portable Generator	Each	2	\$ 3,865.05	50%	50%	\$ 7,730.11
	44	Subtotal – System Procurement, Installation, and Testing (B1 - B8)						\$ 26,658,518.66
C	45	Project Management and Testing Services						
	46	Project Management	Month	72	\$ 57,078.32	100%	0%	\$ 4,109,639.18
	47	Project Documentation (Program-Level Master Documents)	Each	1	\$ 834,154.42	100%	0%	\$ 834,154.42
	48	Project Documentation (Project-Level Standalone Documents)	Each	10	\$ 46,030.18	100%	0%	\$ 460,301.77
	49	Project Documentation (Program-Level Master Document Updates)	Each	10	\$ 13,583.59	100%	0%	\$ 135,835.86
	50	System Design	Each	1	\$ 1,309,580.44	100%	0%	\$ 1,309,580.44
	51	Factory Acceptance Test for Transition Phase 1 (Initial Host & Roadside)	Each	1	\$ 1,082,213.77	100%	0%	\$ 1,082,213.77
	52	Factory Acceptance Tests for Transition Phase 2 (Host & Roadside)	Each	10	\$ 151,585.79	100%	0%	\$ 1,515,857.89
	53	Configuration of Toll Facility Host (ORT Facilities)	Each	7	\$ 46,724.48	100%	0%	\$ 327,071.35
	54	Configuration of Toll Facility Host (Managed Lanes Facilities)	Each	3	\$ 89,046.19	100%	0%	\$ 267,138.58
	55	Site Installation Test (ORT and Managed Lanes Facilities)	Toll Zone	69	\$ 1,210.48	100%	0%	\$ 83,523.38
	56	Integration Test (ORT Facilities)	Toll Zone	53	\$ 18,062.85	100%	0%	\$ 957,331.01
	57	Integration Test (Managed Lanes Facilities)	Toll Zone	16	\$ 12,390.98	100%	0%	\$ 198,255.76
	58	Operational Acceptance Test (ORT Facilities)	Toll Zone	53	\$ 22,458.48	100%	0%	\$ 1,190,299.43
	59	Operational Acceptance Test (Managed Lanes Facilities)	Toll Zone	16	\$ 28,095.52	100%	0%	\$ 449,528.25
	60	Final Operational Acceptance Test (All Facilities)	Each	1	\$ 91,662.05	100%	0%	\$ 91,662.05
	61	System As-Builts	Each	10	\$ 4,607.15	100%	0%	\$ 46,071.50
	62	Subtotal – Project Management and Testing Services						\$ 13,058,464.65
	63	Grand Total – Installation Services (Sections A, B and C)						\$ 41,049,909.24
D	64	Installation Services Optional to CTRMA						
	65	Transaction Aggregation	Lump Sum	1	\$ 48,041.42	100%	0%	\$ 48,041.42
	66	Total – Installation Services Optional to CTRMA						\$ 48,041.42

NOTES:

Installation Services Pricing does not include potential future ITS Services described in Section 2.20 of Appendix 2, Scope of Work.

¹ Shoulders shall be fully instrumented as a lane for purposes of pricing in this section.

² Pricing for Existing Facilities includes no re-use of equipment.

³ Indicates the percentage of the Unit Price that will be adjusted by either the applicable CPI-U or WPU 117, in accordance with Section 2.1.e of the Agreement.

APPENDIX D
Maintenance Services Unit Prices

**Appendix D
Maintenance Services Unit Prices**

SECTION / LINE	DESCRIPTION	UNIT	PROPOSED QTY	UNIT PRICE	APPLICABLE PRICE ADJUSTMENT INDICES ³		TOTAL PRICE	
					CPI-U	WPU 117		
E	1	System Maintenance (includes: all materials, software, equipment, labor, traffic control, FON and network administration and maintenance, etc. required to maintain the ETCS in accordance with the SLAs)						
	2	Toll Zone Maintenance for ORT facilities including emergency power and backup, per lane	Month	8256	\$ 1,672.07	90%	10%	\$ 13,804,649.55
	3	Toll Zone Maintenance for managed lanes facilities, per lane	Month	2256	\$ 1,875.21	90%	10%	\$ 4,230,468.80
	4	Variable Toll Message Signs and associated CCTV, per sign	Month	1440	\$ 405.64	90%	10%	\$ 584,120.30
	5	Radar or Microwave Traffic Speed, Volume, and Density Detection Equipment, per device	Month	2400	\$ 392.80	90%	10%	\$ 942,716.16
	6	Total – System Maintenance						\$ 19,561,954.81
F1	7	System Maintenance - Image Review (Combined Automated and Manual Review)²						
	8	Year-1	Transaction ²	169,499,000	\$ 0.0109	90%	10%	\$ 1,847,539.10
	9	Year-2	Transaction ²	183,040,000	\$ 0.0098	90%	10%	\$ 1,793,792.00
	10	Year-3	Transaction ²	202,260,000	\$ 0.0099	90%	10%	\$ 2,002,374.00
	11	Year-4	Transaction ²	217,394,000	\$ 0.0101	90%	10%	\$ 2,195,679.40
	12	Year-5	Transaction ²	232,681,000	\$ 0.0103	90%	10%	\$ 2,396,614.30
	13	Total – System Maintenance: Image Review						\$ 10,235,998.80
F2	14	System Maintenance - Unit Price for Image Review² (informational only, not used for scoring or payment purposes)						
	15	Manual Image Review Unit Price	Transaction ²		\$ 0.0344			
	16	Automated Image Review Unit Price	Transaction ²		\$ 0.0100			
G	17	System Maintenance - TIM Center Operations						
	18	Traffic and Incident Management Center Supervisor	Month	48	\$ 16,893.83	90%	10%	\$ 810,903.70
	19	Traffic and Incident Management Center Operator	Month	96	\$ 7,982.63	90%	10%	\$ 766,332.71
	20	Total – TIM Center Operations						\$ 1,577,236.41
	21	Grand Total – Maintenance Services						\$ 31,375,190.02

NOTES:

Maintenance Services Pricing does not include potential future ITS Services described in Section 2.20 of Appendix 2, Scope of Work.

¹ Image review pricing by volume ranges, based on pricing categories.

² The image review pricing shall be per transaction, regardless of the number of images associated with the transactions.

³ Indicates the percentage of the Unit Price that will be adjusted by either the applicable CPI-U or WPU 117, in accordance with Section 2.1.e of the Agreement.

APPENDIX E
Labor Rates

**Appendix E
Labor Unit Prices**

SECTION	DESCRIPTION ¹	UNIT	UNIT PRICE	APPLICABLE PRICE ADJUSTMENT INDICES ³	
				CPI-U	WPU 117
H	Labor Unit Prices²				
	Principal-in-Charge	Hour	\$ 214.13	100%	0%
	Program Manager	Hour	\$ 214.13	100%	0%
	Deputy Program Manager	Hour	\$ 96.21	100%	0%
	Installation Manager	Hour	\$ 89.45	100%	0%
	Maintenance Manager	Hour	\$ 89.45	100%	0%
	Quality Manager	Hour	\$ 119.47	100%	0%
	Network Administrator	Hour	\$ 106.34	100%	0%
	Architect	Hour	\$ 114.46	100%	0%
	Business Analyst	Hour	\$ 81.19	100%	0%
	Computer Aided Design	Hour	\$ 53.56	100%	0%
	Application Developer	Hour	\$ 56.48	100%	0%
	Application Developer - Hadoop/Al	Hour	\$ 99.86	100%	0%
	Application Developer - Java	Hour	\$ 82.70	100%	0%
	Lane Control Analyst	Hour	\$ 84.38	100%	0%
	Plans and Controls	Hour	\$ 91.14	100%	0%
	Software Quality Assurance Specialist	Hour	\$ 101.28	100%	0%
	Lead Software Quality Assurance	Hour	\$ 102.97	100%	0%
	Systems Engineer	Hour	\$ 72.27	100%	0%
	System Engineering Manager	Hour	\$ 135.46	100%	0%
	Software Support Manager	Hour	\$ 119.47	100%	0%
	Maintenance Technician	Hour	\$ 53.49	100%	0%
	Technical Writer	Hour	\$ 63.27	100%	0%
	Offshore Application Developer - Java (FPT)	Hour	\$ 27.03	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
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		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%
		Hour	\$ -	100%	0%

- NOTES:**
- ¹ Fully-loaded hourly rates for each position identified.
 - ² To be used for supplemental work authorizations for services not contemplated in Installation Services Unit Prices and/or Maintenance Services Unit Prices.
 - ³ Indicates the percentage of the Unit Price that will be adjusted by either the applicable CPI-U or WPU 117, in accordance with Section 2.1.e of the Agreement.

APPENDIX F
Service Level Agreements



CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

**Agreement for
Electronic Toll Collection System
Integration and Maintenance Services**

Appendix 7

Service Level Agreement

CONTENTS

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7 SERVICE LEVEL AGREEMENT (SLA)

7.1 GENERAL PROVISIONS

The TSI shall meet defined levels of performance in the execution of the Scope of Work. This Appendix 7 describes the minimum performance requirements the TSI must meet. The TSI is responsible for demonstrating that the performance requirements of the RFP and, as otherwise described herein, can be met or exceeded before Final System Acceptance. The measurement of these service level SLAs shall be automated where possible and shall be straightforward and data-driven, as agreed to by the TSI and CTRMA. CTRMA, at their discretion, will periodically audit the reported results.

The TSI shall develop reports that compare actual results to the requirements defined in this appendix and shall submit these reports to CTRMA within ten (10) business days of each month-end. The TSI shall maintain all corresponding data in compliance with the data retention policies outlined in the RFP, and the data shall be made available to CTRMA upon request. The methods and results of the measurement process shall be fully subject to independent audit. They shall be utilized by the TSI to take corrective action to correct any deficiencies and failures to meet the required availability, accuracy, and performance requirements. The TSI shall be subject to liquidated damages as described in the SLA table for failure to provide the required reports within the specified timeframe or if reports are not accurate or complete.

Actual performance shall be defined and measured against the requirements and time periods in the SLA table to assess the availability, accuracy, and performance of the delivered system. This appendix addresses these requirements for the following levels of service:

1. Accuracy
2. Availability
3. System performance
4. Maintenance (Response/Repair timing)

The sections below provide general conditions that apply to the SLAs described herein. Should a specific SLA section define terms or conditions which appear contrary to these general provisions, the terms or conditions within the specific SLA section take precedence.

7.2 KEY PERFORMANCE REQUIREMENTS

7.2.1 Availability Requirements

The Availability requirements, as specified in the SLA table, shall be measured during the Operations Acceptance Test and monthly thereafter. The availability requirements will not include approved scheduled preventive maintenance activities.

These requirements shall be initially applied at the start of the warranty phase. The warranty phase shall conclude after twelve (12) months upon successful completion of the Operational Acceptance Test **and** full project acceptance of each project/facility, as described in Section

2.13.6 of the RFP. Once CTRMA has certified systems acceptance **and** upon expiration of the warranty phase for a system or roadway, dependent on the transition schedule, that roadway or system shall transition to the maintenance phase. The monthly warranty fee or maintenance fee, as applicable, shall be subject to the monthly assessment of availability and reliability measurement, as well as other criteria as outlined in the SLA table, and applicable damages for failure to meet such criteria.

7.2.2 Performance Reviews

CTRMA will review the TSI's performance monthly, using required system reports provided by the TSI, including reports generated and created by MOMS. Performance reviews shall begin one (1) month after commencement of the warranty phase and shall include evaluation of the previous month of operation. CTRMA may elect to waive or impose damages during the first four (4) months of the warranty phase.

The availability calculation will not include downtime during any period when CTRMA does not allow the TSI to close a lane or otherwise work along the roadway unless such failure to approve is the result of the TSI not following the CTRMA procedures in making the request.

7.2.3 Chargeable and Non-Chargeable Failures

For purposes of calculating availability performance requirements for testing and maintenance performance chargeable and non-chargeable failures are defined as follows:

7.2.3.1 Chargeable Failures

Chargeable failures include any failures that are not specifically identified as non-chargeable in Section 7.2.3.2, including but not limited to:

1. A malfunction that prevents the ETCS (hardware or software) from performing its designated function, when used and operated under its intended operational and environmental conditions as detailed in the Scope of Work.
2. A malfunction that poses a threat to the safety of the ETCS components, customers, employees, or others.
3. An occurrence where data is not successfully transmitted between the toll zone locations and the TFH unless the failure is already accounted for as a separate performance failure. For example, if the zone controller is not functioning and does not transmit data to the TFH, the zone would be charged for the failure, but the system would not.
4. Any failure of equipment or software that allows revenue loss to occur on the ETCS that is not already accounted for as a separate performance failure.
5. Significant software anomalies and bugs that affect the performance and operation of the ETCS.
6. Shutdown or unavailability of a toll zone locations and the TFH unless specifically directed.
7. Failure to properly register or transmit a transaction record from a toll zone location and the TFH.
8. Failure to accurately reconcile the ETCS.

9. Failure to transmit a transaction's correct toll amount to the CTRMA Data Platform System.
10. Failure to transmit the correct toll amounts to the CTRMA Data Platform System within the required time.
11. Loss of data either at the lane or TFH level, including failure to meet data retention requirements.
12. Failure to electronically send or receive transaction information.
13. Failure to generate the reports required to reconcile and audit the system.

7.2.3.2 Non-Chargeable Failures

Non-chargeable failures include any failures that are not specifically identified as chargeable in section 7.2.3.1, including but not limited to:

1. Force Majeure Event, as defined in the contract
2. Vandalism
3. System component failures caused by environmental or operating conditions outside the design standards of the equipment
4. Failures that are customer, customer representative, or user induced

7.2.4 Accuracy Requirements

Accuracy requirements are specified in the SLA Table.

7.2.5 Time Constraint Requirements

Time Constraint requirements are specified in the SLA Table.

7.2.6 Maintenance Service Level Requirements

The TSI shall provide sufficient personnel, tools, and other necessary resources to meet the service level requirements defined in the SLA Table.

7.2.6.1 Maintenance Support Requirements

Maintenance response time shall be measured from the time the system generates an alert/ticket, the TSI is notified a priority event has occurred and/or a failure event has occurred, whichever occurs first, and ends when the TSI acknowledges the alert, ticket and/or event via an approved communication method (e.g. MOMS).

Repair time shall be measured from the time the TSI acknowledges the ticket for the event and ends when the failure condition is corrected, and the system is returned to regular operation. If access to the equipment in question is denied to the TSI based on the CTRMA policy, the repair time shall be measured beginning when CTRMA has allowed the TSI access to the equipment.

Both the response time and the repair time shall be registered in the MOMS. Failure to meet the required response and repair times shall be monitored through MOMS reports.

7.2.6.2 Routine Maintenance Activities Requirements

The TSI shall perform routine maintenance activities per the approved maintenance schedule.

7.2.6.3 Stop Clock Conditions

The TSI may be excused from its obligation to meet the performance and service level requirements set forth above under certain conditions that shall be referred to as “Stop Clock Conditions.” Only the time during which such conditions are present shall be excluded from the timeframes used to measure the TSI’s performance as set forth below:

The TSI will exclude from its availability calculations the time arising from any of the following “Stop Clock Conditions”:

1. Loss of connectivity to all the CTRMA provisioned roadside Hub buildings if a third party causes the loss of connectivity to all Hubs, not under the direct or indirect control of the TSI and not reasonably preventable by the TSI, including, but not limited to, fiber cuts not caused by the TSI. For purposes of this provision, the TSI’s employees, affiliates, subsidiaries, data services providers, agents, suppliers, or subcontractors shall be deemed to be under the control of the TSI concerning the equipment, services, or facilities to be provided under this Agreement.
2. The following CTRMA contact/access problems, provided that the TSI makes reasonable efforts to contact the CTRMA approved contacts immediately upon the commencement of the Stop Clock period:
 - a. Access necessary to correct the problem at a CTRMA owned site is not available because access is improperly denied or not arranged by the site contact or the CTRMA representative, provided that the TSI properly scheduled the visit or access beforehand, if advance notice was required.
 - b. The CTRMA construction activities that prevent the TSI from performing scheduled maintenance or repair of in-lane equipment or systems.
 - c. Incorrect site contact information, which prevents access, provided that the TSI takes reasonable steps to notify the CTRMA approved contacts of the improper contact information immediately and takes reasonable steps to obtain the correct information.
3. Routine Scheduled Maintenance provided such schedule was provided to and approved by CTRMA in advance and in writing; provided, however, that in no event shall the Stop Clock Condition time period be extended beyond the standard routine scheduled maintenance time period.
4. Force majeure events.

The TSI shall be required to submit “Stop Clock Documentation” for each use of a Stop Clock Condition. The TSI shall submit documentation to CTRMA as soon as the TSI is aware of a Stop Clock Condition occurring. Failure to provide CTRMA with written notice when a “stop work” event arises waives the TSI’s right to seek Stop Clock Conditions. All Stop Clock Documentation must be included in the TSI’s Monthly Report. CTRMA may evaluate all Stop Clock Documentation and may request additional justification for each Stop Clock Condition. At the discretion of CTRMA, use of Stop Clock Conditions may be rejected, conditionally accepted, or accepted on a case-by-case basis. The TSI shall coordinate with CTRMA to define all processes related to Stop Clock Conditions, notification thereof, documentation requirements and other

processes as necessary, and document those processes in the TSI's Maintenance Plan submitted for CTRMA's review and approval.

If it is determined during the review of a monthly maintenance invoice that the cause of the problem was not the fault or responsibility of CTRMA, or in the event of denied access, if the reason was determined to be proper, then the Stop Clock Condition shall not apply. Further, if it is determined that the cause of the problem was not the fault or responsibility of CTRMA, or in the event of denied access, if the reason was determined to be proper, **after** CTRMA has paid the TSI the monthly maintenance amount for the month in question, CTRMA shall be able to deduct any penalties that should have applied from a future monthly maintenance payment amount.

Notwithstanding any other provision of the contract documents to the contrary, the following Stop Clock Conditions do not apply to:

1. The TSI's response time performance requirements as outlined in the RFP generally and Appendix 7 specifically.
2. Testing or maintenance initiated by the TSI outside of routine scheduled maintenance windows.
3. Power fluctuations caused by electrical utility providers, common carriers, the TSI, the TSI affiliates, subsidiaries, data services providers, or subcontractors.
4. Time period during which CTRMA has made reasonable efforts to notify the TSI of a problem, but the TSI was not available or reachable.
5. Failure of the TSI to provide adequate facilities (including cabinets, sunshields, etc.) to ensure delivery of the contracted services will not be considered a valid stop clock condition to the extent such failure of the TSI contributed to the stop clock condition.
6. Any other reason or cause not expressly listed above for which the TSI is responsible.
7. If the TSI asserts force majeure or failure of the CTRMA provided equipment as an excuse to performance, the TSI shall have the burden of (i) proving sole proximate cause to the satisfaction of CTRMA, (ii) that the TSI took reasonable steps to minimize the delay and damages caused by events when known or should have been known, and (iii) that the TSI timely notified CTRMA of the actual occurrence which is claimed as grounds for a defense under this clause (if any).

7.2.6.4 Help Desk Support Requirements

The TSI shall supply personnel with expertise in support of the system hardware, software, and database management system(s) during the CTRMA working hours (to be determined during the system design phase) to provide a help desk function for all TSI-supplied systems and subsystems. The help desk is intended to act as a central point of contact for all technical support, including hardware and software questions, installation of updated versions of software, networking, network connection requests, and troubleshooting.

7.2.7 Miscellaneous

7.2.7.1 Single Event Causing Cumulative Liquidated Damages

If the TSI can prove to the reasonable satisfaction of CTRMA that a single event causes the TSI to fail to meet more than one SLA, cumulative liquidated damages shall not be imposed. Instead, the highest applicable liquidated damages relative to such occurrence shall apply.

If the TSI fails to complete the repair according to the service levels outlined in the SLAs, then the TSI shall, in addition to the liquidated damages assessed for the single event, will be responsible for liquidated damages resulting from not meeting the repair time service levels for the affected systems.

7.2.7.2 Calculation of Damages

To calculate liquidated damages, all timeframes stated in the Damages column of the following chart shall be the time stated or any portion thereof. By way of example and not by limitation, if in SLA AC2, the Automatic Vehicle Classification results in a score of 99.47, failing to meet the required 99.75% SLA by 0.28%, for one toll zone, then the liquidated damages assessed for failure to meet this SLA will be 1% + 1% + 1% (3%) of the monthly maintenance fee. The examples below assume a monthly maintenance fee of \$100,000 for illustrative purposes.

Table 7-1: Calculation of Damages

SLA	Result	Difference	Penalty	Sample Calculated Damage
99.90%	99.62%	0.3 below required SLA	Every 0.1% below the SLA damages of 1% of the monthly maintenance fee.	Monthly Maintenance fee X (1% + 1% + 1%) or 3% x \$100,000 = \$3,000
99.99%	99.75%	0.2 below required SLA	Every 0.1% below the SLA damages of 2% of the monthly maintenance fee.	Monthly Maintenance fee x (2% + 2%) or 4% x \$100,000 = \$4,000
98.00%	97.86%	0.1 below required SLA	Every 0.1% below the SLA damages of 5% of the monthly maintenance fee.	Monthly Maintenance fee .05% x \$100,000 = \$5,000
99.50%	99.44	0.1 below required SLA	\$200 per each 0.1% below threshold	\$200
3hrs	> 3 hrs. 1 min to <= 3 hrs. 20 min	20 min	\$300 for every 20 minutes beyond the SLA per event.	\$300
3hrs	> 3 hrs. 20 min to <= 3 hrs. 40 min	40 min	\$300 for every 20 minutes beyond the SLA per event.	\$600

Formulas for measuring each SLA have been provided for each SLA description below. While a measurement formula is provided, the TSI shall coordinate with CTRMA to review, finalize and agree upon all measurement formulas prior to execution of the Contract. The TSI shall document each approved, agreed upon measurement method within their Maintenance Plan

for CTRMA's review and approval. The TSI shall be responsible for updating their Maintenance Plan to reflect the most current version of the measurement formulas should CTRMA request or agree to modify any formula in the future.

7.2.7.3 Calculation of Damages for Consecutive Failures

Recurring and consecutive failure to comply with the SLAs provided in this Agreement will result in substantial harm to CTRMA, but damages from such harm are difficult to quantify. Damages will increase for prolonged periods, and therefore for any SLA that is missed for three consecutive months, the liquidated damages will be doubled for each subsequent month where the SLA is missed. The liquidated damages will revert to the original value upon the SLA being met for a month.

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement									
Accuracy														
AC1 – AC4 applies to all vehicles, traveling through a toll zone that are separated from other vehicles in the same travel lane, at speeds from stop-and-go to 100 mph.														
AC1 – AC4 are measured for each gantry location by direction .														
AC1	Automatic Vehicle Detection	<p>Each vehicle passing through a gantry location will be detected/reported once, and only once (no exception made for degradation or loss in the availability of the AVC), including vehicles in the shoulders and straddling the lane and shoulder.</p> <p>The TSI will reconcile failed performance from the audits within 30 calendar days.</p>	99.80% with an 80% Confidence Level	For each gantry location by direction, every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	<p>Each month, the TSI shall audit gantry location(s), by direction, as designated by CTRMA with a statistically significant sample size, as shown below, to show SLA compliance. The TSI shall use the same sample set for the AC1 and AC2 monthly audits.</p> <p>The TSI shall coordinate with CTRMA to ensure that every gantry location receives an audit within a calendar year. The TSI shall coordinate with CTRMA to determine the gantry locations to be audited each month.</p> <p>Accruing more errors than allowed as indicated in the following table shall result in an audit failure of AC1:</p> <table border="1" data-bbox="1360 1075 1747 1222"> <thead> <tr> <th>Sample Set</th> <th>Required Samples</th> <th>Allowed Errors</th> </tr> </thead> <tbody> <tr> <td>Set 1</td> <td>804</td> <td>0</td> </tr> <tr> <td>Set 2</td> <td>1,497</td> <td>1</td> </tr> </tbody> </table>	Sample Set	Required Samples	Allowed Errors	Set 1	804	0	Set 2	1,497	1
		Sample Set	Required Samples	Allowed Errors										
Set 1	804	0												
Set 2	1,497	1												
<p>Measurement method:</p> $\text{Automatic Vehicle Detection Accuracy (Per Gantry Location by Direction) \%} = \left[1 - \left(\frac{\text{Number of missed and duplicate vehicles}}{\text{Total number of vehicles in sample}} \right) \right] \times 100$														

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
		<ol style="list-style-type: none"> 1. During OAT, the TSI will deploy DVAS cameras to all locations and will record enough video to support the sample size described above. 2. The TSI will provide video data and system-generated transaction reports each month upon request to CTRMA to determine the accuracy of Vehicle Detection. The required format of video and reports will be defined in the design phase of the project. 3. The TSI shall provide a summary report describing the results of this video audit, with all discrepancies clearly identified and an SLA result. 4. The TSI shall include the results of this report for calculation of the Vehicle Detection SLA and possible damages in their Monthly Maintenance Report. 5. At their discretion, CTRMA may perform, or seek the assistance of a third-party, to perform an audit of this SLA in addition to the TSI's audit. 6. CTRMA shall enforce damages on any failing SLA, whether calculated by the TSI, CTRMA, or a CTRMA-designated third-party. 7. At CTRMA's discretion, CTRMA shall require the TSI to re-audit locations that have failed to meet the SLA measurement for the previous month. 			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement									
AC2	Automatic Vehicle Classification	<p>Each vehicle passing through a gantry location with vehicle classification requirements will be correctly classified, including vehicles straddling the lanes. Shoulders are excluded from this calculation.</p> <p>The TSI will reconcile discrepancies from the audits within 30 calendar days.</p>	99.75% with an 80% Confidence Level	For each gantry location by direction, every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	<p>Each month, the TSI shall audit gantry location(s), by direction, as designated by CTRMA with a statistically significant sample size, as shown below, to show SLA compliance. The TSI shall use the same sample set for the AC1 and AC2 monthly audits.</p> <p>The TSI shall coordinate with CTRMA to ensure that every plaza location receives an audit within a calendar year. The TSI shall coordinate with CTRMA to determine the gantry locations to be audited each month.</p> <p>Accruing more errors than allowed as indicated in the following table shall result in an audit failure of AC2:</p> <table border="1" data-bbox="1360 857 1747 1003"> <thead> <tr> <th>Sample Set</th> <th>Required Samples</th> <th>Allowed Errors</th> </tr> </thead> <tbody> <tr> <td>Set 1</td> <td>1,711</td> <td>2</td> </tr> <tr> <td>Set 2</td> <td>2,205</td> <td>3</td> </tr> </tbody> </table>	Sample Set	Required Samples	Allowed Errors	Set 1	1,711	2	Set 2	2,205	3
Sample Set	Required Samples	Allowed Errors												
Set 1	1,711	2												
Set 2	2,205	3												
<p>Measurement method:</p> <p><i>Automatic Vehicle Classification Accuracy (Per Gantry Location by Direction)%</i></p> $= \left[1 - \left(\frac{\text{Axle-Based Classification Errors}}{\text{Total number of vehicles in sample}} \right) \right] \times 100$ <ol style="list-style-type: none"> During OAT, the TSI will deploy DVAS cameras to all locations and will record enough video to support the sample size described above. TSI will provide video data and system-generated transaction reports each month upon request to the CTRMA to determine the accuracy of Vehicle Classification. The required format of video and reports will be defined in the design phase of the project. 														

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
		<ol style="list-style-type: none"> 3. The TSI shall provide a summary report describing the results of this video audit, with all discrepancies clearly identified and an SLA result. 4. The TSI shall include the results of this report for calculation of the Vehicle Classification SLA and possible damages in their Monthly Maintenance Report. 5. At their discretion, CTRMA may perform, or seek the assistance of a third-party, to perform an audit of this SLA in addition to the TSI's audit. 6. CTRMA shall enforce damages on any failing SLA, whether calculated by the TSI, CTRMA, or a CTRMA-designated third-party. 7. At CTRMA's discretion, CTRMA shall require the TSI to re-audit locations that have failed to meet the SLA measurement for the previous month. 			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement									
AC3	Automatic Vehicle Identification	<p>The AVI subsystem will correctly detect, read, and correlate to the correct vehicle 99.80% of all properly installed Transponders on all detected vehicles, including vehicles straddling the lanes.</p> <p>The TSI will reconcile discrepancies from the audits within 30 calendar days.</p>	99.80% with an 80% Confidence Level	For each gantry location by direction, every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	<p>Each month, the TSI shall audit gantry location(s), by direction, as designated by CTRMA with a statistically significant sample size, as shown below, to show the SLA compliance. The TSI shall use the same sample set for the AC1 and AC2 monthly audits.</p> <p>The TSI shall coordinate with CTRMA to ensure that every plaza location receives an audit within a calendar year. The TSI shall coordinate with CTRMA to determine the plaza locations to be audited each month.</p> <p>Accruing more errors than allowed as indicated in the following table shall result in an audit failure of AC3:</p> <table border="1" data-bbox="1360 932 1747 1078"> <thead> <tr> <th>Sample Set</th> <th>Required Samples</th> <th>Allowed Errors</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>804</td> <td>0</td> </tr> <tr> <td>2</td> <td>1,497</td> <td>1</td> </tr> </tbody> </table>	Sample Set	Required Samples	Allowed Errors	1	804	0	2	1,497	1
Sample Set	Required Samples	Allowed Errors												
1	804	0												
2	1,497	1												
<p>Measurement method:</p> $ \text{Automatic Vehicle Identification Accuracy (per Gantry Location by Direction)\%} = \left[1 - \left(\frac{(\text{Detection and Read Errors}) + (\text{Correlation Errors})}{(\text{Detection and Read Audited Samples}) + (\text{Correlation Audited Samples})} \right) \right] \times 100 $ <p>For AVI Detect and Read Accuracy:</p> <ol style="list-style-type: none"> The TSI shall develop a report that provides all vehicle transactions per gantry location. From this data set, the transactions shall be filtered for tag reads and non-tag read vehicle transactions. 														

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
		<ol style="list-style-type: none"> 2. Another filter query shall remove transactions with an indicated vehicle speed between stop-and-go to 100 mph. 3. From this data set, transactions with the same transponder shall be matched with other vehicle transactions that occurred on the same roadway, on the same day. 4. The accuracy is calculated by the number of vehicles charged as an iToll at a plaza that had a tag read on the same roadway, on the same day. This value is then divided by the total number of vehicles at that plaza on that day. <p>For AVI Correlation Errors:</p> <ol style="list-style-type: none"> 1. The TSI shall develop a report that provides transactions and all images captured for each transaction occurring within a CTRMA selected time. Only AVI transactions will be used. All non-AVI transactions shall be removed. 2. Transactions shall be matched with other vehicle transactions that occurred on the roadway in the same audit period. 3. During a manual image review process, the images of the audited transponder transactions shall be compared to images from another transaction for the same transponder. If the images from both transactions show the same vehicle, this represents a correct AVI correlation. 4. However, if the images from both initial transactions show different vehicles, images from a third transaction for the audited transponder shall be compared. 5. If the images from this third transaction match the audited transaction, the audit shall consider the audited transponder correctly correlated to the transaction. 6. If the images of the third transaction do not match the audited transaction, the audit shall consider the audited transponder to have an AVI correlation error. 7. At their discretion, CTRMA may perform, or seek the assistance of a third-party, to perform an audit of this SLA in addition to the TSI's audit. 8. CTRMA shall enforce damages on any failing SLA, whether calculated by the TSI, CTRMA, or a CTRMA-designated third-party. 9. At CTRMA's discretion, CTRMA shall require the TSI to re-audit locations that have failed to meet the SLA measurement for the previous month. 			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
AC4	VES Image Capture and Correlation Accuracy	<p>The VES will correctly capture and associate one front human-readable license plate image or one rear human-readable license plate image and associated with the correct vehicle for 99.80% of all detected vehicles, including vehicles straddling the lane and shoulder.</p> <p>Measurement method:</p> $VES \text{ Image Capture and Correlation Accuracy (for each Gantry Location by Direction)\%} = \left[1 - \left(\frac{\text{Detected Vehicles Without a Readable Front and Rear License Plate Image}}{\text{All Detected Vehicles} - \text{Exclusions}} \right) \right] \times 100$ <ol style="list-style-type: none"> 1. A monthly, system-wide report, that calculates image readability performance from code-off within the image reviewed transactions. 2. This metric only evaluates legally mounted license plates. 3. Excludes: <ol style="list-style-type: none"> a. Vehicles traveling in the wrong direction. b. Vehicles in tow using rope, chains, or other unorthodox methods. c. Vehicles with missing, damaged, or obstructed license plates. 	99.80%	For each gantry location by direction, every 0.5% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	Each month, as reported in TSI provided reports.
AC5	False "Coded-off" Images	<p>For transactions rejected by the automated and/ or manual review process, less than 1.00% shall have incorrect code-off results.</p> <p>"Coded-Off" means the TSI stated they could not determine the license plate data.</p>	<1.50%	Every 0.1% above the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	<p>Each month, as determined by TSI audited sample of code-offs.</p> <p>TSI shall coordinate with CTRMA monthly to determine a statistically significant sample size, as shown below, to show the SLA compliance.</p> <p>The TSI shall coordinate with CTRMA to determine the plaza</p>

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement									
		<p>Measurement method:</p> $\text{Measured Accuracy \%} = \left(\frac{\text{Images Incorrectly Coded Off}}{\text{All Manually Reviewed Images}} \right) \times 100$			<p>location(s) to be audited each month.</p> <p>Accruing more errors than allowed as indicated in the following table shall result in an audit failure of AC5:</p> <table border="1" data-bbox="1600 537 1986 683"> <thead> <tr> <th>Sample Set</th> <th>Required Samples</th> <th>Allowed Errors</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>107</td> <td>0</td> </tr> <tr> <td>2</td> <td>199</td> <td>1</td> </tr> </tbody> </table>	Sample Set	Required Samples	Allowed Errors	1	107	0	2	199	1
Sample Set	Required Samples	Allowed Errors												
1	107	0												
2	199	1												
AC6	License Plate Read Accuracy	<p>Percentage of Human Readable Plate Images that are correctly determined either with ALPR or automated and/ or manual review.</p> <p>“Correctly determined” means that the plate number, jurisdiction, and any plate type are accurate.</p> <p>The TSI shall correctly determine the License plate number, jurisdiction, and type information for all transactions processed requiring license plate number identification for billing purposes.</p>	98.50% with an 80% Confidence Level	For every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	<p>Each month, as determined by TSI audited sample of image-based transactions.</p> <p>TSI shall coordinate with CTRMA monthly to determine a statistically significant sample size, as shown below, to show the SLA compliance.</p> <p>The TSI shall coordinate with CTRMA to determine the plaza location(s) to be audited each month.</p>									

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement									
					<p>Accruing more errors than allowed as indicated in the following table shall result in an audit failure of AC6:</p> <table border="1"> <thead> <tr> <th>Sample Set</th> <th>Required Samples</th> <th>Allowed Errors</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>107</td> <td>0</td> </tr> <tr> <td>2</td> <td>199</td> <td>1</td> </tr> </tbody> </table>	Sample Set	Required Samples	Allowed Errors	1	107	0	2	199	1
Sample Set	Required Samples	Allowed Errors												
1	107	0												
2	199	1												
		<p>Measurement method:</p> $\text{License Plate Read Accuracy \%} = \left(\frac{\text{Number of Correctly Determined Vehicle License plates}}{\text{Total number of vehicle license plates}} \right) \times 100$												
AC7	Express Lane Trip Building	99.50% of all transactions shall be correctly assembled into trips per CTRMA business rules on all express lane roadways, which use trip building for tolling.	99.50%	For every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	Each month, as determined by TSI provided reports.									
		<p>Measurement method:</p> $\text{Express Lane Trip Accuracy \%} = \left[1 - \left(\frac{\text{Express Lane Transactions Not Assembled into a Trip}}{\text{Express Lane Transactions Assembled into a Trip}} \right) \right] \times 100$												
SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement									

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
AC8	Non-Express Lane Trip Aggregation* *Note – AC8 only applies if the TSI implements trip aggregation	99.50% of all transactions shall be correctly assembled into trips per the CTRMA business rules on all non-express lane roadways, which use trip aggregation for tolling.	99.50%	For every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	Each month, as determined by TSI provided reports.
		Measurement method: $\text{Non – Express Lane Trip Aggregation Accuracy \%} = \left[1 - \left(\frac{\text{Non Express Lane Transactions Not Assembled into a Trip}}{\text{Non Express Lane Transactions Assembled into a Trip}} \right) \right] \times 100$			
AC9	VTMS Accuracy	Each VTMS will post and maintain the correct toll rate per the CTRMA business rules to the VTMS 99.95% of the time.	99.95%	Average of historical fare amount during the outage periods, regardless of CTRMA’s ability to collect the fares.	Each month, as determined by TSI provided reports.
		Measurement method: $\text{VTMS Accuracy \%} = \left[1 - \left(\frac{\text{Time VTMS Shows Incorrect Toll Rate}}{\text{Expected Hours of Operations}} \right) \right] \times 100$			

SLA ID	SLA Name	Key Performance Indicator Description		Service Level Agreement	Damages	Measurement Requirement									
AC10	MVDS Volume Accuracy	The volume provided by Traffic Detection Systems (MVDS) shall be 90.00% accurate.	90.00% with an 80% Confidence Level		For every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	<p>Each month, as determined by TSI audited sample of MVDS vehicle volume.</p> <p>TSI shall coordinate with CTRMA monthly to determine a statistically significant sample size, as shown below, to show the SLA compliance.</p> <p>The TSI shall coordinate with CTRMA to determine the MVDS(s) to be audited each month.</p> <p>Accruing more errors than allowed as indicated in the following table shall result in an audit failure of AC10:</p> <table border="1" data-bbox="1602 963 1986 1112"> <thead> <tr> <th>Sample Set</th> <th>Required Samples</th> <th>Allowed Errors</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>16</td> <td>0</td> </tr> <tr> <td>2</td> <td>29</td> <td>1</td> </tr> </tbody> </table>	Sample Set	Required Samples	Allowed Errors	1	16	0	2	29	1
Sample Set	Required Samples	Allowed Errors													
1	16	0													
2	29	1													
		<p>Measurement method:</p> $MVDS \text{ Volume Accuracy } \% = \left[1 - \left(\frac{\frac{DVAS}{CCTV} \text{ Volume} - MVDS \text{ Volume}}{\frac{DVAS}{CCTV} \text{ Volume}} \right) \right] \times 100$ <p>The MVDS Volume is the volume provided by the MVDS being measured, and the DVAS/CCTV Volume is the volume calculated by monitoring the DVAS/CCTV camera(s) near the MVDS being measured.</p>													

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
Performance					
SP1	Aggregated/Trip Transaction Transaction processing time	<p>99.90% of all transactions must be fully processed within four (4) calendar days of the transaction creation date (lane date) and successfully transmitted to the CTRMA Data Platform System per approved the CTRMA business rules within agreed constraints of any external the CTRMA systems or interfaces.</p> <p>Measurement method:</p> $\text{Transaction Processing Time Performance \%} = \left(\frac{\text{Number of Processed Aggregated/Trip Transactions within required time}}{\text{Number of Processed Aggregated/Trip Transactions}} \right) \times 100$	99.90% within four (4) calendar days	Actual transaction fare amount from the delayed transactions, regardless of CTRMA’s ability to collect the fares.	Each month, as determined by TSI provided reports.
SP2	Non-Aggregated/Trip Transaction Transaction processing time	<p>99.90% of all transactions must be fully processed within two (2) calendar days of the transaction creation date (lane date) and successfully transmitted to the CTRMA Data Platform System per approved the CTRMA business rules within agreed constraints of any external the CTRMA systems or interfaces.</p> <p>Measurement method:</p> $\text{Transaction Processing Time Performance \%} = \left(\frac{\text{Number of Processed Non – Aggregated/Trip Transactions within required time}}{\text{Number of Processed Non – Aggregated/Trip Transactions}} \right) \times 100$	99.90% within two (2) calendar days	Actual transaction fare amount from the delayed transactions, regardless of CTRMA’s ability to collect the fares.	Each month, as determined by TSI provided reports.

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
SP3	Image Processing time (manual or automated)	For transactions requiring a manual or automated review process, 99.0% shall be completed within 72 hours from the time the transaction qualified for manual review.	99.0% within 72 hours	For every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	Each month, as determined by TSI provided reports.
		Measurement method: $\text{Image Processing Time Performance \%} = \left(\frac{\text{Number of Transaction Reviews Completed within required time}}{\text{Number of Transactions Sent to Review}} \right) \times 100$			
SP4	Monthly Maintenance Report processing time	The monthly report, accurately detailing system performance relative to all Project SLAs, shall be submitted to CTRMA within ten (10) business days of each month-end, commencing the first full month (Month 1) following go-live (start of revenue collection).	Within ten (10) business days of each month-end.	For every 1 calendar day outside the SLA, 1% of the monthly maintenance fee.	Determined by date Monthly Maintenance report received (email timestamp).
		Measurement method: $\text{Report Submission Date} = (\text{Date}_{\text{Report Delivered}}) - (\text{Date}_{\text{Report Due}})$			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
SP5	Report Generation (> 1,000,000 records)	<p>Report Generation pertains to the display of non-ad-hoc reports generated on all systems delivered under the scope of the Project, measured from the time the user completes the report request in the UI to the time the report is displayed on the screen or generated as a .csv file. For the measurement of this SLA, no more than three queries that will result in 1,000,000+ records returned will be conducted simultaneously.</p> <p>Measurement method:</p> $> 1M \text{ Report Generation time} = (Report_{Report \text{ start time}}) - (Report_{Report \text{ end time}})$	<p>Within 5 minutes for Every 1,000,000 records included in the report.</p>	<p>For each sample set's times taken as an average, for every 5 minutes outside the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.</p>	<p>Each month, as determined by TSI provided reports</p>
SP6	Report Generation (< 1,000,000 records)	<p>Report Generation pertains to the display of non-ad hoc reports generated on the Facility Host and all other systems developed under the scope of the Project, measured from the time the user completes the report request in the UI to the time the report is displayed on the screen or generated as a .csv file.</p> <p>Measurement method:</p> $< 1M \text{ Report Generation time} = (Report_{Report \text{ start time}}) - (Report_{Report \text{ end time}})$	<p>99.90% within 60 seconds and 95.00% within 20 seconds.</p>	<p>For each sample set's times taken as an average, for every 1 minute outside the SLA, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.</p>	<p>Each month, as determined by TSI provided reports.</p>

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
SP7	Submission of Monthly Inventory Report	<p>The monthly Inventory report, accurately detailing the location, count, and serial numbers of all the CTRMA hardware, including retired hardware (if applicable), spares and Return Material Authorization (RMA) hardware for the previous calendar month, shall be submitted to CTRMA within ten (10) business days of each month-end, commencing the first full month (Month 1) following go-live (start of revenue collection).</p> <p>Measurement method:</p> $Report\ Submission\ Date = (Date_{Report\ Delivered}) - (Date_{Report\ Due})$	Within ten (10) business days of each month-end.	For the monthly inventory report every 1 calendar day outside the SLA, 1% of the monthly maintenance fee.	Determined by date Monthly Inventory report received (email timestamp).
SP8	Submission of Yearly Inventory Report	<p>The TSI shall perform a full physical inventory audit annually to verify consistency between the MOMS inventory management system and the actual count.</p> <p>The Yearly Inventory report shall accurately detail the location, count, and serial numbers of all the CTRMA hardware, including retired hardware (if applicable), spares, and outstanding Return Material Authorization (RMA) hardware for the previous calendar year.</p> <p>The Yearly Inventory Report shall be submitted to CTRMA each year, commencing the first full month (Month</p>	<p>Months 1 – 11: Initial report submitted on month 12 within ten (10) business days from the beginning of the 12th month.</p> <p>Months 12 and beyond: Report submitted on month 12 within ten (10) business days from the beginning of the 12th month.</p>	For the yearly report, every 1 calendar day outside the SLA, 1% of the monthly maintenance fee.	Determined by date Annual Inventory report received (email timestamp).

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
		1) following go-live (start of revenue collection).			
		Measurement method: $Report\ Submission\ Date = (Date_{Report\ Delivered}) - (Date_{Report\ Due})$			
SP9	Submission of Annual SOC Audit Report	<p>TSI must provide a "SOC 1 Type 2" Report or a SOC 1 readiness assessment 180 days after first system acceptance, and a SOC 1 Type 2 Report for all subsequent submittals.</p> <p>The TSI must address any exceptions identified in the SOC I Type 2 report within 30 calendar days from the date the SOC I Type 2 is delivered to the CTRMA.</p>	<p>If the TSI is unable to address all exceptions within 30 calendar days, the TSI must submit a written management plan to the CTRMA detailing the planned actions to address all remaining exceptions within 90 calendar days from the initial SOC report submission date.</p> <p>If the TSI is unable to address all exceptions within 90 calendar days, the TSI must submit a revised written management plan to the CTRMA detailing the planned actions and schedule to address all remaining exceptions within 120 calendar days from the initial SOC report submission date.</p>	<p>5% of the monthly maintenance fee each month beginning after 1 month from the date the SOC report was delivered to CTRMA until all exceptions have been addressed to CTRMA's satisfaction.</p> <p>25% of the monthly maintenance fee each month beginning after 3 months from the date the SOC report was delivered to CTRMA until all exceptions have been addressed to CTRMA's satisfaction.</p>	Determined by date SOC report is due per the Agreement

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
			If the TSI is unable to address all exceptions within 120 calendar days, the TSI must submit a revised written management plan to the CTRMA detailing the planned actions and schedule to address all remaining exceptions within 180 calendar days from the initial SOC report submission date.	100% of the monthly maintenance fee each month beginning after 4 months from the date the SOC report was delivered to CTRMA until all exceptions have been addressed to CTRMA's satisfaction.	

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
Availability					
AV1	Lane Availability	Each lane shall be available 99.5% of the time. An available lane is defined as a lane with the ability to collect revenue through both image capture and tag read/association. Measurement method: $\text{Measured Availability \%} = \left[1 - \left(\frac{\text{Lane Downtime}}{\text{Lane Uptime} + (\text{Lane Downtime} - \text{Exception Time})} \right) \right] \times 100$	99.5%	For each lane, every 0.1% below the SLA, the TSI shall be subject to liquidated damages in the amount of \$200.	Each month, as determined by TSI provided reports.
AV2	Host Availability	The Host Level applications and the system shall be available 99.50% of the time, excluding scheduled maintenance.	99.50%	For every 0.1% or portion thereof below the SLA, the	Each month, as determined by TSI provided reports.

		An available host is defined as a fully operating host, including hardware and software such that all applications, reports, MOMS, and transaction processing are online and available for users.		TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	
		Measurement method:			
		$\text{Measured Availability \%} = \left[1 - \left(\frac{\text{Host Downtime}}{\text{Total Host Expected Operational Time}} \right) \right] \times 100$			
		Each Express Lanes CCTV shall be available 98.0% of the time, excluding scheduled maintenance.	98.0%	\$200 per each 0.1% below threshold.	Each month, as determined by TSI provided reports.
AV3	Express Lane CCTV Availability	Measurement method:			
		$\begin{aligned} &\text{Measured Availability \%} \\ &= \left[1 - \left(\frac{(\text{Total Hours Express Lane CCTV System Downtime}) - \text{Exclusions}}{(\text{Expected Hours of Operations}) - \text{Exclusions}} \right) \right] \times 100 \end{aligned}$			
		Each non-Express Lane CCTV shall be available 95% of the time, excluding scheduled maintenance.	95%	\$200 per each 0.1% below threshold.	Each month, as determined by TSI provided reports.
AV4	Non-Express Lane CCTV Availability	Measurement method:			
		$\begin{aligned} &\text{Measured Availability \%} \\ &= \left[1 - \left(\frac{(\text{Total Hours Non - Express Lane CCTV System Downtime}) - \text{Exclusions}}{(\text{Expected Hours of Operations}) - \text{Exclusions}} \right) \right] \times 100 \end{aligned}$			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
AV5	Express lane MVD availability	Each Express Lane Segment shall be available 99.90% of the time. An available segment is defined as a segment where at least 75% of MVD sensors are available at any given time.	99.90% per segment	For every 0.1% or portion thereof below the SLA per segment, the TSI shall be subject to liquidated damages in the amount of 1% of the monthly maintenance fee.	Each month, as determined by TSI provided reports.
		Measurement method: $\text{Measured Availability \%} = \left[1 - \left(\frac{(\text{Total Hours Express Lane MVD System Downtime}) - \text{Exclusions}}{(\text{Expected Hours of Operations}) - \text{Exclusions}} \right) \right] \times 100$			
AV6	VTMS Availability	Each VTMS shall be available 99.80%, excluding scheduled maintenance.	99.80%	Average of historical fare amount during the outage periods, regardless of CTRMA's ability to collect the fares.	Each month, as determined by TSI provided reports.
		Measurement method: $\text{Measured Availability \%} = \left[1 - \left(\frac{(\text{Total Hours VTMS System Downtime}) - \text{Exclusions}}{(\text{Expected Hours of Operations}) - \text{Exclusions}} \right) \right] \times 100$			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
Maintenance (Response/Repair timing)					
<p>Response Time: Response Time is always measured as beginning when the system generates an alert/ticket, the TSI is notified a priority event has occurred and/or a failure event has occurred, whichever occurs first, and ending when the TSI acknowledges the alert, ticket and/or event via an approved communication method (e.g. MOMS).</p>					
<p>Repair Time: Repair time is always measured as beginning when the time the TSI acknowledges the ticket for the event or failure and ending when the failure condition is corrected, and the system is returned to normal operation.</p>					
<p>Priority 1: Failure that will result in: loss of ability to accurately collect revenue; inability to accurately and timely process transactions or trips per the CTRMA business rules; lane closure; safety hazard; or loss of auditability.</p>					
RR1	Time to Respond – Priority 1	All priority 1 events must have a ticket created and be acknowledged within 15 minutes of notification of a priority 1 event.	15 minutes	\$300 for every 30 minutes beyond the SLA per event.	Each month, as determined by TSI provided reports.
		Measurement method: $P1 \text{ Response Time} = \text{minimum of } (T_{Arrival} - T_{Notice}) \text{ or } (T_{Acknowledge} - T_{Notice})$			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
RR2	Time to Repair – Priority 1	All priority 1 tickets must be repaired within 3 hours of ticket acknowledgement.	3 hours	\$500 for every 30 minutes beyond the SLA per event.	Each month, as determined by TSI provided reports.
		Measurement method: $P1 \text{ Repair Time} = (T_{Corrected} - T_{Notice})$			
Priority 2: Failure of a system component that will result in a degradation of system performance or results in the loss of redundancy in a key system component but does not qualify as a Priority 1 event.					
RR3	Time to Respond – Priority 2	All priority 2 events must have a ticket created and be acknowledged within 30 minutes of notification of a priority 2 event.	30 minutes	\$150 for every 30 minutes beyond the SLA per event.	Each month, as determined by TSI provided reports.
		Measurement method: $P2 \text{ Response Time} = \text{minimum of } (T_{Arrival} - T_{Notice}) \text{ or } (T_{Acknowledge} - T_{Notice})$			
RR4	Time to Repair – Priority 2	All priority 2 tickets must be repaired within 6 hours of ticket acknowledgement.	6 hours	\$250 for every 30 minutes beyond the SLA per event.	Each month, as determined by TSI provided reports.
		Measurement method: $P2 \text{ Repair Time} = (T_{Corrected} - T_{Notice})$			

SLA ID	SLA Name	Key Performance Indicator Description	Service Level Agreement	Damages	Measurement Requirement
Priority 3: Any action or event reported that will/may impact operational performance, has potential of degrading the System performance, and has no impact to revenue collection.					
RR5	Time to Respond – Priority 3	All priority 3 events must have a ticket created and be acknowledged within 30 minutes of notification of a priority 3 event. Measurement method: $P3 \text{ Response Time} = \text{minimum of } (T_{Arrival} - T_{Notice}) \text{ or } (T_{Acknowledge} - T_{Notice})$	30 minutes	\$75 for every 30 minutes beyond the SLA per event.	Each month, as determined by TSI provided reports.
RR6	Time to Repair – Priority 3	All priority 3 tickets must be repaired within 24 hours of ticket acknowledgement. Measurement method: $P3 \text{ Repair Time} = (T_{Corrected} - T_{Notice})$	24 hours	\$125 for every 30 minutes beyond the SLA per event.	Each month, as determined by TSI provided reports.

APPENDIX G
Key Personnel

KEY PERSONNEL

Darby Swank	Principal-in-Charge
Mike Yager	Program Manager
Danielle Bordeaux	Deputy Program Manager
Kenneth Engelke	Installation Manager and Interim Onsite Maintenance Manager
Donnie Collins	Maintenance Manager
Quality Manager	Ken Acosta

APPENDIX H
Contractor's Proposal

APPENDIX I-1
Form of Installation Performance Bond

FORM OF INSTALLATION PERFORMANCE BOND

**AGREEMENT FOR ROADSIDE TOLL COLLECTION SYSTEM INSTALLATION
AND MAINTENANCE SERVICES**

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS, that Electronic Transaction Consultants, LLC, a Delaware limited liability company, as “Principal” and _____, as “Surety” or as “Co-Sureties”, each a corporation duly organized under the laws of the State indicated on the attached page, having its principal place of business at the address listed on the attached page, in the State indicated on the attached page, and authorized as a surety in the State of Texas, are hereby jointly and severally held and firmly bound unto the CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY (the “Authority”), a political subdivision of the State of Texas, as “Obligee”, in the sum of [\$_____] (the “Bonded Sum”), for the payment whereof Principal and Surety (or Co-Sureties), bind themselves, and their heirs, executors, administrators, representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Obligee, has awarded to Principal, the Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services, duly executed and delivered as of [_____], 202[] (the “Agreement”), on the terms and conditions set forth therein; and

WHEREAS, upon the issuance of Work Authorization Number __, dated _____ pursuant to Article 2, subsection 2.1., Principal is required to furnish a bond guaranteeing the faithful performance of its obligations under the Agreement;.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if Principal shall promptly and faithfully perform all of its obligations under the Agreement, including any and all amendments and supplements thereto, then this obligation shall be null and void; otherwise it shall remain in full force and effect. The Obligee shall release this bond upon the conclusion of the term of the Agreement as set forth in Article (7)(d)(ii) of the Agreement.

The following terms and conditions shall apply with respect to this bond:

1. The Agreement is incorporated by reference herein.
2. This bond specifically guarantees (1) the performance of each and every obligation of Principal under the Agreement, as it may be amended and supplemented, including but not limited to, its liability for liquidated damages as specified in the Agreement, but not to exceed the penal amount described in Article (7)(d)(ii).
3. Whenever Principal shall be, and is declared by the Obligee to be, in default under the Agreement and the Obligee has formally terminated the Principal’s right to complete the Services required under the Agreement, provided that the Obligee is not then in material default thereunder, Surety shall promptly take one of the following actions with the consent of the Obligee:

- a. arrange for the Principal to perform and complete the Agreement;
- b. complete the Services required under the Work Authorization then in effect in accordance with the terms and conditions of the Agreement then in effect, through its agents or through independent contractors;
- c. obtain bids or negotiated proposals from qualified contractors acceptable to the Obligee for a contract for performance and completion of the Services required under the Work Authorization, arrange for a contract to be prepared for execution by the Obligee and the contractor selected with the Obligee's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Agreement in an amount that corresponds to the amount of the Work Authorization to be completed, and pay to the Obligee the amount of damages as described in Article 7 of the Agreement; or
- d. waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances, (i) after investigation, determine the amount for which it may be liable to the Obligee and, as soon as practicable after the amount is determined, tender payment therefore to the Obligee, or (ii) deny liability in whole or in part and notify the Obligee citing reasons therefore.

5. If Surety does not proceed as provided in Paragraph 3 with reasonable promptness, Surety shall be deemed to be in default on this Bond fifteen (15) days after receipt of an additional written notice from the Obligee to Surety demanding that Surety perform its obligations under this Bond, and the Obligee shall be entitled to enforce any remedy available to the Obligee. If Surety proceeds as provided in Subparagraph 3.d, and the Obligee refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice the Obligee shall be entitled to enforce any remedy available to the Obligee.

6. After the Obligee has terminated the Principal's right to complete the Agreement, and if Surety elects to act under Subparagraph 3.a, 3.b, or 3.c above, then the responsibilities of Surety to the Obligee shall not be greater than those of the Principal under the Agreement, and the responsibilities of the Obligee to Surety shall not be greater than those of the Obligee under the Agreement. To the limit of the Bonded Sum, Surety is obligated without duplication for:

- a. the responsibilities of the Principal for correction of defective work and completion of the Services required under the Agreement;
- b. additional legal and delay costs resulting from Principal's default, and resulting from the actions or failure to act of Surety under Paragraph 3; and
- c. liquidated damages under the Agreement.

7. No alteration, modification or supplement to the Agreement or the nature of the work to be performed thereunder, including without limitation any extension of time for performance, shall in any way affect the obligations of Surety under this bond.

8. Correspondence or claims relating to this bond should be sent to Surety at the following address:

9. No right of action shall accrue on this bond to or for the use of any entity other than the Obligee or its successors and assigns.

10. If any legal action be filed on this bond, venue shall be in Travis County, Texas.

11. This bond is executed in accordance with the provisions of Chapter 2253 of the Texas Government Code, as amended.

12. Initially capitalized terms not otherwise defined herein shall have the definition set forth in the Agreement.

IN WITNESS WHEREOF, Principal and Surety have caused this bond to be executed and delivered as of [_____], 202[_____].

Principal:

By: _____

Its: _____

(Seal)

Surety:

By: _____

Its: _____

(Seal)

[ADD APPROPRIATE SURETY ACKNOWLEDGMENTS]

APPENDIX I-2
Form of Installation Payment Bond

FORM OF INSTALLATION PAYMENT BOND

**AGREEMENT FOR ROADSIDE TOLL COLLECTION SYSTEM INSTALLATION
AND MAINTENANCE SERVICES**

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS, that Electronic Transaction Consultants, LLC, a Delaware limited liability company, as “Principal” and _____, as “Surety” or as “Co-Sureties”, each a corporation duly organized under the laws of the State indicated on the attached page, having its principal place of business at the address listed on the attached page, in the State indicated on the attached page, and authorized as a surety in the State of Texas, are hereby jointly and severally held and firmly bound unto the CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY (the “Authority”), a political subdivision of the State of Texas, as “Obligee”, in the sum of [\$_____] (the “Bonded Sum”), for the payment whereof Principal and Surety (or Co-Sureties), bind themselves, and their heirs, executors, administrators, representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Obligee, has awarded to Principal, the Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services, duly executed and delivered as of [_____], 202[] (the “Agreement”), on the terms and conditions set forth therein; and

WHEREAS, upon the issuance of Work Authorization Number __, dated _____ pursuant to Article 2, subsection 2.1., Principal is required to furnish a bond guaranteeing payment of claims, subcontractors, suppliers, materialmen and mechanics.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if Principal shall fail to pay any valid and timely claims of subcontractors, suppliers, materialmen and mechanics with respect to the Services, then Surety shall pay for the same in an amount not to exceed, in the aggregate, the Bonded Sum; otherwise this obligation shall be null and void upon the conclusion of the term of the Agreement as set forth in Article (7)(d)(ii) of the Agreement.

The following terms and conditions shall apply with respect to this bond:

1. The Agreement is incorporated by reference herein.
2. No alteration, modification or supplement to the Agreement or the nature of the work to be performed thereunder, including without limitation any extension of time for performance, shall in any way affect the obligations of Surety under this bond.
3. Correspondence or claims relating to this bond should be sent to Surety at the following address:

4. This bond shall inure to the benefit of the persons identified above so as to give a right of action to such persons and their assigns in any suit brought upon this bond.

5. To the extent permitted by law, the only permitted claimants under this Bond shall be those entities having a contract with Principal and those entities having a contract with an entity which has a contract with Principal.

6. If any legal action be filed on this bond, venue shall be in Travis County, Texas.

7. This bond is executed in accordance with the provisions of Chapter 2253 of the Texas Government Code, as amended.

8. Initially capitalized terms not otherwise defined herein shall have the definition set forth in the Agreement.

IN WITNESS WHEREOF, Principal and Surety have caused this bond to be executed and delivered as of [_____], 202[_____].

Principal:

By: _____

Its: _____

(Seal)

Surety:

By: _____

Its: _____

(Seal)

[ADD APPROPRIATE SURETY ACKNOWLEDGMENTS]

APPENDIX J-1
Form of Maintenance Performance Bond

FORM OF MAINTENANCE PERFORMANCE BOND

**AGREEMENT FOR ROADSIDE TOLL COLLECTION SYSTEM INSTALLATION
AND MAINTENANCE SERVICES**

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS, that Electronic Transaction Consultants, LLC, a Delaware limited liability company, as “Principal” and _____, as “Surety” or as “Co-Sureties”, each a corporation duly organized under the laws of the State indicated on the attached page, having its principal place of business at the address listed on the attached page, in the State indicated on the attached page, and authorized as a surety in the State of Texas, are hereby jointly and severally held and firmly bound unto the CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY (the “Authority”), a political subdivision of the State of Texas, as “Obligee”, in the sum of [\$_____] (the “Bonded Sum”), for the payment whereof Principal and Surety (or Co-Sureties), bind themselves, and their heirs, executors, administrators, representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Obligee, has awarded to Principal, the Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services, duly executed and delivered as of [_____], 202[___] (the “Agreement”), on the terms and conditions set forth therein; and

WHEREAS, as a condition to any final acceptance for Work Authorization Number ___, dated _____ pursuant to Article 2, subsection 2.1, and prior to the issuance of the Work Authorization under Article 2, subsection 2.2., Principal is required to furnish a bond guaranteeing the faithful performance of its obligations under the Agreement;

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if Principal shall promptly and faithfully perform all of its obligations under the Agreement, including any and all amendments and supplements thereto, then this obligation shall be null and void; otherwise it shall remain in full force and effect. The Obligee shall release this bond upon the conclusion of the term of the Agreement as set forth in Article (7)(d)(iii) of the Agreement.

The following terms and conditions shall apply with respect to this bond:

1. The Agreement is incorporated by reference herein.
2. This bond specifically guarantees (1) the performance of each and every obligation of Principal under the Agreement, as it may be amended and supplemented, including but not limited to, its liability for liquidated damages as specified in the Agreement and loss of revenue incurred by the CTRMA under Article 7(b), but not to exceed the penal amount described in Article (7)(d)(iii).
3. Whenever Principal shall be, and is declared by the Obligee to be, in default under the Agreement and the Obligee has formally terminated the Principal’s right to complete the Services required under the Agreement, provided that the Obligee is not then in material

default thereunder, Surety shall promptly take one of the following actions with the consent of the Obligee:

- a. arrange for the Principal to perform and complete the Agreement;
- b. complete the Services required under any Work Authorization(s) then in effect in accordance with the terms and conditions of the Agreement then in effect, through its agents or through independent contractors;
- c. obtain bids or negotiated proposals from qualified contractors acceptable to the Obligee for a contract for performance and completion of the Services required under any Work Authorization(s) then in effect, arrange for a contract to be prepared for execution by the Obligee and the contractor selected with the Obligee's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Agreement in an amount that corresponds to the amount of Work Authorization(s) to be completed, and pay to the Obligee the amount of damages as described in Article 7 of the Agreement; or
- d. waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances, (i) after investigation, determine the amount for which it may be liable to the Obligee and, as soon as practicable after the amount is determined, tender payment therefore to the Obligee, or (ii) deny liability in whole or in part and notify the Obligee citing reasons therefore.

5. If Surety does not proceed as provided in Paragraph 3 with reasonable promptness, Surety shall be deemed to be in default on this Bond fifteen (15) days after receipt of an additional written notice from the Obligee to Surety demanding that Surety perform its obligations under this Bond, and the Obligee shall be entitled to enforce any remedy available to the Obligee. If Surety proceeds as provided in Subparagraph 3.d, and the Obligee refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice the Obligee shall be entitled to enforce any remedy available to the Obligee.

6. After the Obligee has terminated the Principal's right to complete the Agreement, and if Surety elects to act under Subparagraph 3.a, 3.b, or 3.c above, then the responsibilities of Surety to the Obligee shall not be greater than those of the Principal under the Agreement, and the responsibilities of the Obligee to Surety shall not be greater than those of the Obligee under the Agreement. To the limit of the Bonded Sum, Surety is obligated without duplication for:

- a. the responsibilities of the Principal for correction of defective work and completion of the Services required under the Agreement;
- b. additional legal and delay costs resulting from Principal's default, and resulting from the actions or failure to act of Surety under Paragraph 3; and

c. liquidated damages under the Agreement.

7. No alteration, modification or supplement to the Agreement or the nature of the work to be performed thereunder, including without limitation any extension of time for performance, shall in any way affect the obligations of Surety under this bond.

8. Correspondence or claims relating to this bond should be sent to Surety at the following address:

9. No right of action shall accrue on this bond to or for the use of any entity other than the Obligee or its successors and assigns.

10. If any legal action be filed on this bond, venue shall be in Travis County, Texas.

11. This bond is executed in accordance with the provisions of Chapter 2253 of the Texas Government Code, as amended.

12. Initially capitalized terms not otherwise defined herein shall have the definition set forth in the Agreement.

IN WITNESS WHEREOF, Principal and Surety have caused this bond to be executed and delivered as of [_____], 202[_____].

Principal: _____

By: _____

Its: _____

(Seal)

Surety: _____

By: _____

Its: _____

(Seal)

[ADD APPROPRIATE SURETY ACKNOWLEDGMENTS]

APPENDIX J-2
Form of Maintenance Payment Bond

FORM OF MAINTENANCE PAYMENT BOND

**AGREEMENT FOR ROADSIDE TOLL COLLECTION SYSTEM INSTALLATION
AND MAINTENANCE SERVICES**

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS, that Electronic Transaction Consultants, LLC, a Delaware limited liability company, as “Principal” and _____, as “Surety” or as “Co-Sureties”, each a corporation duly organized under the laws of the State indicated on the attached page, having its principal place of business at the address listed on the attached page, in the State indicated on the attached page, and authorized as a surety in the State of Texas, are hereby jointly and severally held and firmly bound unto the CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY (the “Authority”), a political subdivision of the State of Texas, as “Obligee”, in the sum of [\$_____] (the “Bonded Sum”), for the payment whereof Principal and Surety (or Co-Sureties), bind themselves, and their heirs, executors, administrators, representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Obligee, has awarded to Principal, the Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services, duly executed and delivered as of [_____], 202[] (the “Agreement”), on the terms and conditions set forth therein; and

WHEREAS, as a condition to any final acceptance for each Work Authorization under Article 2, subsection 2.1, and prior to the issuance of the Work Authorization under Article 2, subsection 2.2., Principal is required to furnish a bond guaranteeing payment of claims, subcontractors, suppliers, materialmen and mechanics.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT, if Principal shall fail to pay any valid and timely claims of subcontractors, suppliers, materialmen and mechanics with respect to the Services, then Surety shall pay for the same in an amount not to exceed, in the aggregate, the Bonded Sum; otherwise this obligation shall be null and void upon the conclusion of the term of the Agreement as set forth in Article (7)(d)(iii) of the Agreement.

The following terms and conditions shall apply with respect to this bond:

1. The Agreement is incorporated by reference herein.
2. No alteration, modification or supplement to the Agreement or the nature of the work to be performed thereunder, including without limitation any extension of time for performance, shall in any way affect the obligations of Surety under this bond.
3. Correspondence or claims relating to this bond should be sent to Surety at the following address:

4. This bond shall inure to the benefit of the persons identified above so as to give a right of action to such persons and their assigns in any suit brought upon this bond.
5. To the extent permitted by law, the only permitted claimants under this Bond shall be those entities having a contract with Principal and those entities having a contract with an entity which has a contract with Principal.
6. If any legal action be filed on this bond, venue shall be in Travis County, Texas.
7. This bond is executed in accordance with the provisions of Chapter 2253 of the Texas Government Code, as amended.
8. Initially capitalized terms not otherwise defined herein shall have the definition set forth in the Agreement.

IN WITNESS WHEREOF, Principal and Surety have caused this bond to be executed and delivered as of [_____], 202[_____].

Principal:

By: _____

Its: _____

(Seal)

Surety:

By: _____

Its: _____

(Seal)

[ADD APPROPRIATE SURETY ACKNOWLEDGMENTS]

APPENDIX K
Corporate Parent Guaranty

GUARANTY

TO: Central Texas Regional Mobility Authority (“**CTRMA**”)

RE: [____], 202[] Amended and Restated Agreement for Roadside Toll Collection System Installation and Maintenance Services (the “**Agreement**”) by and between Electronic Transaction Consultants, LLC (“**ETC**”) and CTRMA

FOR VALUE RECEIVED AND TO INDUCE CTRMA TO ENTER INTO THE AGREEMENT, subject to the terms of this Guaranty, Quarterhill Inc. (“**Quarterhill**”), a corporation existing under the laws of Canada and the ultimate parent corporation of ETC, hereby unconditionally and irrevocably guarantees to CTRMA the prompt and complete payment when due, by acceleration or otherwise, of amounts of any lost revenue of CTRMA actually owing by ETC to CTRMA pursuant to the Agreement and caused by the acts or omissions of ETC for those lanes and roads under the supervision and control of ETC or otherwise impacted by ETC, meaning, for clarity, CTRMA will accept revenue from the Electronic Toll Collection System provided and maintained by ETC (the “**Obligations**”). CTRMA understands and agrees that the foregoing is a guaranty of collection only, except as provided hereafter. Quarterhill shall not be required to make any payment under this Guaranty unless and until commercially reasonable attempts by CTRMA to collect from ETC after making proper demand have failed. Notwithstanding the foregoing, in the event of the bankruptcy, insolvency, dissolution or liquidation of ETC, Quarterhill shall be required to perform under this Guaranty and pay amounts claimed without the requirement for any further action to be taken by CTRMA against ETC.

Quarterhill shall not be required to cause any Obligations to be paid unless and until it receives a written demand from CTRMA for performance hereunder (a “**Demand**”) specifying with particularity the unpaid amount and any calculations relating thereto and demanding that Quarterhill pay such unpaid amount pursuant to this Guaranty. Quarterhill shall have no obligation under any Demand or hereunder if and to the extent of any actual payment of the unpaid amount that is received by CTRMA from ETC or any other person prior to the date on which such amount shall be due from Quarterhill pursuant to this Guaranty. Quarterhill shall have 30 days after receipt of a Demand to pay the unpaid amount to CTRMA. With respect to any Demand, Quarterhill shall be entitled to assert any and all rights, remedies and defenses which would otherwise be available to ETC under the Agreement or otherwise; provided, however, that Quarterhill hereby waives and agrees not to assert or take advantage of any defense based upon any voluntary or involuntary bankruptcy, insolvency, reorganization, dissolution, arrangement, readjustment, assignment for the benefit of creditors, composition, receivership, liquidation, marshalling of assets and liabilities or similar events or proceedings with respect to ETC or Quarterhill or any of their respective property or creditors, or any action taken by any trustee or receiver or by any court in any such proceeding.

If this Guaranty shall be placed in the hands of an attorney for collection, demand of payment or should payment be demanded through legal proceedings or through any probate or bankruptcy court, Quarterhill agrees to pay to CTRMA its reasonable attorneys’ or collection fees.

Notwithstanding anything contained in this Guaranty or the Agreement to the contrary, Quarterhill’s aggregate liability hereunder shall not exceed US\$10,000,000.

This Guaranty shall continue in full force and effect until the earliest of: (1) the date on which the Agreement is terminated; or (2) midnight, Central Time on December 15, 2027; **provided**, however, that notwithstanding any such termination, this Guaranty shall continue in full force and effect with respect to any Obligations arising from events that occurred prior to the date of such termination.

This Guaranty shall be governed and construed in accordance with the internal laws of the State of Texas without giving effect to its principles of conflicts of law. Quarterhill and CTRMA expressly agree that venue for any action, litigation or other proceeding of any kind or description (whether in law or equity, in contract or tort, or otherwise) arising out of or in any way relating to this Guaranty shall be brought in federal court of the United States of America located in the Western District of Texas (and any appellate courts thereof) and expressly consent to the jurisdiction of such courts

Any notice, communication, request, demand or other document, required or permitted to be given or sent or delivered hereunder shall be in writing and shall be sufficiently given or sent or delivered if it is delivered personally to the party entitled to receive it by internationally recognized courier or E-mail as follows: (a) to Quarterhill at 25 King Street West, Toronto, Ontario, M5L 2A1 Canada, Attention: General Counsel (E-mail: legal@quarterhill.com); or (b) to CTRMA at _____, Attention: _____ (E-mail: _____). The parties may change their respective contact information contained in this Guaranty by providing written notice to the other party. All notices, communications, requests, demands or other documents given pursuant to this Guaranty shall be deemed to have been received: in the case of a letter, when delivered, if delivered personally (as evidenced by a signed receipt) or sent by internationally recognized courier; and, in the case of an E-mail, on the business day in the jurisdiction of receipt following the business day on which it is sent.

There are no third-party beneficiaries of this Guaranty. This Guaranty may not be assigned by CTRMA without Quarterhill's prior written consent. This Guaranty represents the final agreement between CTRMA and Quarterhill with respect to the matters addressed herein and may not be contradicted by evidence of prior, contemporaneous, or subsequent oral agreements of CTRMA and/or Quarterhill. This Guaranty may not be modified, amended or waived, except in writing signed by duly authorized representatives of each of CTRMA and Quarterhill.

QUARTERHILL INC.

Signed: _____
Name: _____
Title: _____
Date: _____

ACCEPTED BY:

CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

Signed: _____
Name: _____
Title: _____
Date: _____